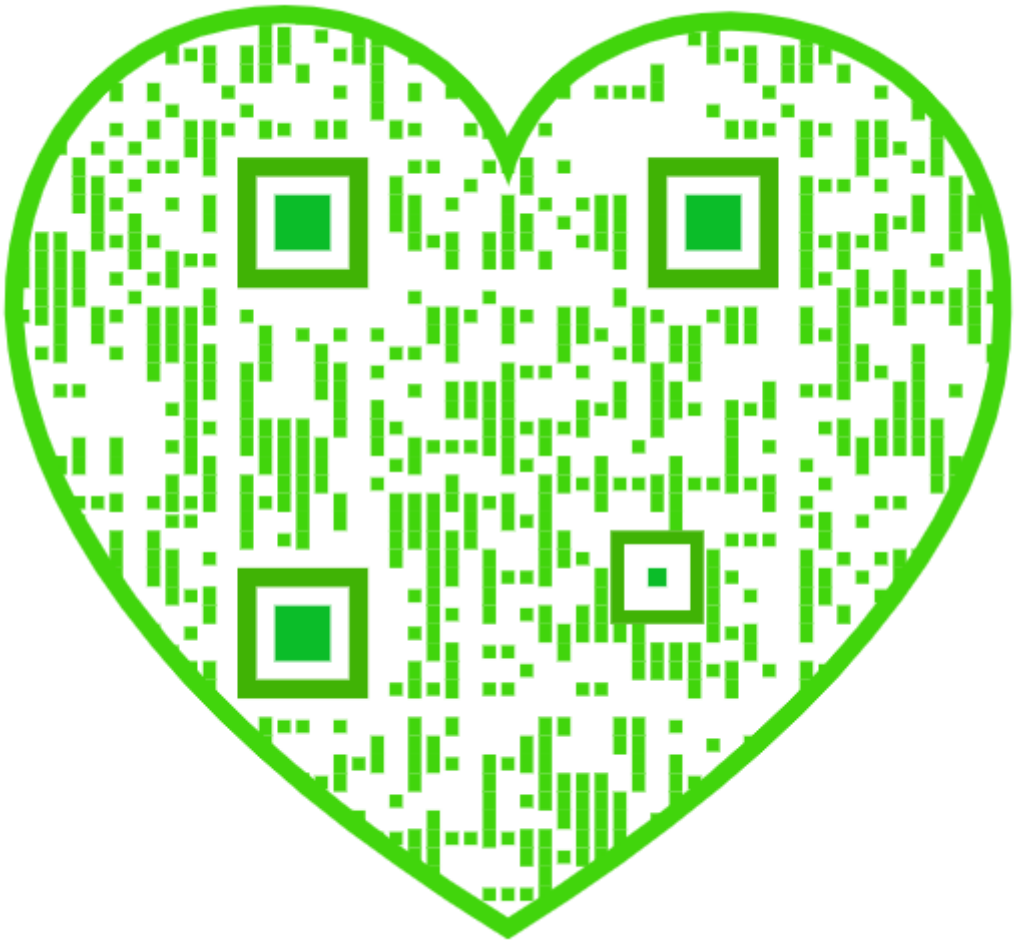

The
Expert House Painter

A COMPLETE EXPOSITION OF THE ART AND PRACTISE OF HOUSE AND STRUCTURAL PAINTING, INTERIOR AND EXTERIOR

Including Surfaces of Wood, Plaster, Stucco, Cement and Concrete, Iron, Steel, Galvanized Iron, Tin, Copper, Etc.

Containing Also a Full Description of All the Pigments and Liquids Used in the Work, Latest Methods of Treatment, Very Full Color Schemes For All Kinds of Buildings, Estimates of Materials, Quantities and Covering Capacity Etc.

BY

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TABLE OF CONTENTS

	Pages
Painting Interior Woodwork	3- 6
Flat Finishes	7- 10
Enamel Painting	11- 21
Painting Smooth, Hard Plaster Walls	22- 39
Flat Wall Paints	40- 51
Painting Floors	52- 57
Preparing and Painting Interior Walls	58- 67.
Painting New Exterior Woodwork	68- 88
Repainting	89-110
Good Painting Difficult	111-123
Painting by Spraying	124-126
Painting Brick Walls	127-137
Painting Over Cement and Concrete	138-150
Staining and Painting Shingles	151-158
Painting with Red Lead	159-168
Painting Tin Roofs	169-178
Painting and Bronzing Radiators	179-182
Painting Structural Ironwork	183-190
Painting Galvanized Iron	191-196
Exterior Color Schemes	197-210
Pigments Used by House Painters	211-233
White Lead	234-245
Zinc White	246-254
Mixing Colors	255-281
Linseed Oil	282-296
Thinners and Solvents	297-311
Some Little-Used Paint Oils	312-314
Driers	315-327
Some Facts and Figures	328-357
Marine Painting	358-366
Glazing Sash (Illustrated)	367-383
Putty	384-396

PAGES
Sandpaper and Its Uses (Illustrated).....397-399
Bridling Brushes (Illustrated).....400-406
The Jour.'s Brush, Cleaning Brushes, Care of Brushes, Practical Brush Notes, What Brush Makers Tell Us, with illustrations.....407-416
Scaffold Work (Illustrated).....417-432
Fitting Out the Paint Shop.....433-438
Origin and Nature of Color.....439-446
White Lead Poisoning.....447-452
Painters' Questions Answered—Ninety Pages.....453-544
Notes on Painting Iron and Other Metals.....545-555
Practical Paint Notes.....556-563
Practical Notes for Painters.....564-578
Composition of Paint and Their Cost.....579-597

PAINTING WOOD-WORK—INTERIOR

HE priming of interior wood-work is done according to the character of the wood. Treatment of the old white pine wood, scarce now, but dear to memory still, requires little description; well thinned white lead paint, little driers, is all that is required. But as much of the white pine of to-day contains much sap and hard spots, these require attention. The sap will require touching up with an extra coat; the hard parts will need to be well brushed out, with heavier or less oily paint. For a white job it may be necessary to coat the work with white shellac. Then sandpapering, for the smoother the work is made at the start the easier it will be to maintain smoothness to the finish. It is well when sandpapering to lay down stiff paper or cloth, to catch the lead dust, after which the cloth or paper may be shaken out of doors. Dust off woodwork after sandpapering. Putty all nail holes and other imperfections. A putty made of white lead and whiting, or adding some white lead to the usual putty, according to color of finish desired, will be better than ordinary putty, which is difficult to hide with several coats of white. White lead putty dries harder and does not shrink as whiting putty is apt to do.

In sandpapering, if the paper is slightly dampened with benzine or turpentine, there will be no dust to fly. Shellac all knots and sappy places, using the white shellac and using it thin. Many prefer to shellac on the priming coat. There does not seem to be any particular advantage in this. Shellac in grain or denatured alcohol is better than that in wood alcohol. Never use wood alcohol at all.

New brushes will not give as smooth a job as brushes that have been worn some, or until the roughness has been taken off. It requires a smooth brush to effect a smooth job of painting. If the brush has been broken-in on outside or rough work, it will then be fit to do good smooth work, inside or outside, but more particularly inside work, for here the brush marks are more apt to show, on account of the stiff nature of turpentine paint; while on outside painting the paint, oil-mixed, will flow enough, usually, to obliterate all brush marks. There should be a full set of brushes, 8-0 or 10-0, as may be preferred, and according to character of work, whether large or small surfaces. A large brush will not do so well on a rather small surface. But time may be saved and good work done by using as large a tool as the nature of the work will admit of; often a painter will be found painting with a sash tool where he should be using a pound brush.

The best work can only be done when the right paint is used, and when the paint is well rubbed in and out. A paint that won't admit of a great deal of rubbing out is a very poor sort of paint. Rubbing-out is called for on each and every coat, from priming to finish.

A white dead flat job requires making each coat perfectly smooth, and two things will help greatly in effecting a smooth finish, namely, making the priming coat perfectly smooth and level, and careful brush work at every stage of the work.

If, when painting over dark putty, or over any dark marks, you will discolor the white a trifle, it will make a good white finish. Add a little lampblack to the white, to just turn it from the white, though if the dark marks are very pronounced you will have to increase the tint of the white accordingly.

White coach japan does very well in interior white paint, in place of patent paste drier or lead acetate (sugar of lead). But a first-class job of dead flat white finish demands sugar of lead. Patent drier is simply a mixture of sugar of lead and whiting.

For dead-flat work the white lead in oil must be drawn, a process which may be briefly described as follows: Mix up some white lead with turpentine and let it stand, say over night. In the morning the oil will have risen to the top of the paint, and may be skimmed off. Repeat this process, leaving the paint stand until night, then skim off the oil again. In some cases it may be necessary to remove all the risin liquid, and mix again with fresh turpentine. This will give a lead much freer from oil than the single-drawn process. By this means enough oil remains in the lead to act as a binder, but not enough to yellow the finish. Remembering that it is not the lead, but the oil that yellows. Zinc white mixed with oil will also yellow, just as readily and as greatly as white lead in oil.

To make a good rubbed white job, prime as directed for woodwork, and make perfectly smooth with sandpaper. Thin the second coat of lead with two parts of turpentine and one part of oil, adding a little white japan drier. For the third coat thin the lead with turpentine only, adding a little white japan drier. See that each coat is sandpapered smooth. And allow ample time for hardening. The fourth coat should be, for strictly first-class work, flake white ground in varnish and thinned with turpentine. This may be followed by finishing coat, using the very best French zinc white ground in damar varnish and thinned down with some high-grade white rubbing varnish, adding enough turpentine to make the paint flow out and level

down right. This last coat is the one that is to be rubbed down.

The smoother you keep the work as it progresses the less the number of coats it will require. For instance, if the under coats have not been made perfectly level and smooth, then it will require two or three coats to make a good rubbing surface. Also, if the job is done on old work, well smoothed, it will not require as many coats as on new work.

For flatting work neither benzine nor turpentine substitutes is anywhere near being as good as pure gum spirits of turpentine. Nor is wood turpentine, extracted from stumps and hard pine waste, as good. In fact, benzine will evaporate and leave nothing of itself behind. Turpentine also evaporates, but not entirely, for it leaves a gummy residue which serves the purpose of flatting. As regards the action of benzine we will have something to say in another part of this work. It certainly makes a paint softer, which condition the paint retains to some extent after drying.

The action of benzine on inside white paint is to turn it yellow, while pure turpentine will bleach it. This was discovered in an oilcloth factory, when the cloth on which was used benzine paint yellowed in spite of all that could be done to prevent it, for the cause was not known. Finally it was suspected that the benzine was at the bottom of the trouble, and thenceforth none was used, and the trouble ceased.

FLAT FINISHES

FIRST-CLASS INTERIOR FLAT WORK.—The following method is given by one of our most expert painters: For a good job of flat work inside, prime with white lead thinned with two-thirds raw oil and one-third turpentine and a little japan drier. Mix the second coat, after sandpapering smooth and puttying up holes with white lead putty, white lead thinned with equal parts of oil and turpentine. Use nothing coarser than No. 1 paper for the sanding off. For third coat, sandpaper with No. 2 paper, dust off and coat with white lead and thin with turpentine, adding a little white japan. Fourth coat, French process zinc in oil thinned with turpentine, with white japan dryers. Fifth and last coat may be made from French process American zinc ground in damar varnish, reduced with turpentine, adding white japan dryers.

DRAWN FLATTING.—The oil flat colors are produced in various ways, one of the oldest known methods being to withdraw the oil from keg lead by repeated washings with turpentine; the keg lead is broken up with turpentine, the pigment allowed to settle, the oily liquid poured off, the paste again treated in the same manner, and finally thinned to brush consistency with more turpentine. The degree of flatness regulated by the number of washings, consequently it was possible to obtain an "egg-shell" or "dead flat" finish.

The more modern method, applicable to all colors, consists in grinding the pigment in a mixture of oil, japan and turpentine, thinning with turpentine and

adding just enough "flat" varnish to make the paint level out properly.

If "half-and-half" is required, then equal parts of linseed oil and turpentine should be mixed in a can and the paint thinned with it in the preceding manner. If a "flat ground" is required simply thin the paint with pure turpentine. In this case, however, about one and one-half ounces of driers will be found sufficient for each pound of paint mixed.

For dead flat effects, follow the above method, using turpentine instead of linseed oil. Allow the paint to stand over night and skim off the oil which rises to the top. In some special cases it may be found desirable to pour off all the liquid, again mix thoroughly with fresh turpentine and let stand and skim off as before.

Flat spirit colors are made by grinding the pigment in a thin shellac, mastic, or sandarach varnish containing a small quantity of castor oil. The main object of this kind of paint is that it can only be thinned with denatured alcohol or similar spirit. The finish, however, is very beautiful, and is far more durable than might be expected.

Flat japan colors are a simple proposition, the pigments ground in japan being thinned to brush consistency by mixing with turpentine. These colors, however, are not much in favor, as they have a peculiar flatness and lack of durability.

The flat varnish colors are made by grinding a suitable pigment in a mixture of "flat varnish," oil and turpentine; they are not exactly "dead flat," but dry down to an ivory-like, or egg-shell finish.

Flat wall finishes are in direct contrast to the enamels, and are even more complex in composition, as they may embrace varnish, oil, japan, spirit, and water colors.

You cannot do a satisfactory job of flatting unless you stop all suction in the plaster.

The walls and ceiling will require, at least, three or four coats of oil paint before flatting. The number of undercoats depends upon the porosity of the plaster.

The last coat before flatting ought to dry glossy, without any sunken places where suction has not been stopped, and should not stand too long, nor dry too hard, before flatting.

There are many ways of mixing flatting, there are also many good flat paints, ready mixed, on the market,

Some painters mix flatting in this way: Take white lead or colors ground in oil as required, thin down to consistency of thick cream with turpentine only.

Do not add any oil, there is enough oil in the ground oil colors to bind it. To stop the turps from evaporating too quickly while applying the flatting. stir a teacupful of water into a can of flatting. It is better to mix the turps and water together first. You will find this mixture works cool (no driers required). Another way to mix flatting is to mix your colors ground in oil with turps as before, then add about a pint of raw linseed oil (not boiled oil) to a gallon of flatting, then add two or three handfuls of whiting and beat all up together well and strain. The whiting will absorb the oil and the paint will dry flat, if enough whiting has been added. (No driers required.)

Do not attempt to apply flatting as you would apply paint.

The proper way to apply flatting is to take a 4-inch flat brush and apply a full coat quickly, with as little effort as possible to cover the surface, then stipple it.

Do not try to spread the flatting even or lay it off, the stippler will do all that.

When using the stippler, don't pound it. Use it gently

In doing any job of flatting you must work very quickly.

Don't try to use benzine instead of turps.

Benzine or gasoline are too greasy and will dry streaky.

Don't use dry colors, although a little will not hurt.

Don't miss any stippling, it will show.

Don't allow the edge of a stretch to get set.

Don't stipple in the same place twice.

ENAMEL PAINTING

THE term enamel was formerly applied to all paints which dried with a brilliant luster and a hard, shell-like, non-porous surface. Recently, however, a distinction has been made between the true enamels and the so-called "varnish colors."

As a rule, enamels are made by grinding a pigment in an enamel varnish and then reducing this paste to a brush consistency, with more varnish and possibly a small quantity of thinner.

The pigment generally used for white enamels is "Green Seal" zinc oxide, but any other brand of pure oxide will answer fully as well, providing the color is satisfactory. The tinted enamels are produced by adding a small quantity of any desired color to the white enamel; the tinting colors usually being ground in equal parts of bleached oil and white grinding japan.

The varnishes most suitable for enamels are damar and white copal, the former being used for special white enamels and the latter for hard, tough enamels.

Some of the cheaper grades are adulterated with W. W. rosin. The Batavia gum produces the whitest or palest varnish.

Zinc sulphate or zinc resinate is occasionally added to harden the damar, and a very small quantity of alcohol is often introduced to clear up the milky or cloudy effect sometimes obtained in such varnishes.

White enamel containing oil or colored resin will eventually turn yellow when excluded from the light, consequently white enamels designed for the interiors

of refrigerators, closets, etc., must be made with damar, the best and palest Batavia gum being used for this purpose.

The damar gum, after being hardened by a special treatment, is dissolved in pure spirits of turpentine, the ratio of the "cut" (solution) varying from 6 to 10 pounds of gum to the gallon of turpentine. Wood or stump turpentine cannot be used for this purpose on account of its turning yellow in the dark. Many cheap white and tinted enamels, however, contain wood turpentine, and, unless the odor has been masked with oil of mirbane, or some similar scent, its presence may be detected by the smell.

Acetone, benzol and benzine are also occasionally used in enamels, either as a solvent for the gum or as a thinner, but unlike wood turpentine and rosin spirit, they impart no color.

When an enamel paste is made by grinding zinc oxide in an enamel varnish, and this paste is further diluted with varnish to obtain an enamel of proper brush consistency, it will be found that a small quantity of thinner will have to be added in order to make it level out.

Turpentine, on account of its flowing property, is the best thinner, but unfortunately it has a tendency to flat the enamel, consequently it is customary to use a mixture consisting of equal parts of turpentine and benzine.

Benzine has no flatting property, but owing to damar and copal being difficult to dissolve in this liquid, it cannot be used in excess.

In thinning damar, enamel or any other short-oil varnish with benzine add the liquid slowly, a little at a time, and stir continually until thoroughly mixed.

Refrigerator enamel, made from hardened damar, and containing no oil or colored resin, is the whitest and most lustrous of all the enamels, and on account of its not turning yellow in the dark is used exclusively for the interiors of refrigerators, cabinets, linen chests, deposit boxes, etc. It is extremely hard, but not very elastic; consequently a non-absorbent primer must be used as an under coat.

Superior results are obtained by baking, a bake of four to six hours at a temperature of 180 deg., F., producing an extraordinary hard, tough finish.

Polishing enamel differs from the "refrigerator," in that it contains a colored resin, *i. e.*, white copal and some refined oil. This enamel is generally quick drying and must harden in twenty-four to forty-eight hours so as to be sanded or rubbed down with pumice.

An extra fine job may be produced by giving the work a coat of non-absorbent primer, two coats of polishing enamel, rubbing or sanding, and finishing with a coat of universal, exterior or marine enamel.

Exterior enamel is intended only for work exposed to the weather. On account of it being made from slow-drying, pale finishing varnish it is seldom used for interior work, and will not answer at all for work excluded from the light, as it soon turns yellow in the dark.

Its chief use is for store fronts, yachts, camp furniture, etc.

Marine enamel, as the name implies, is made to withstand water, and is especially suitable for bath tubs, sinks, water pails, etc.

Cold and hot water have no effect on this material when dry, and if the enamel is baked it will stand submersion in fresh or salt water for months without softening. Enamel to withstand the effect of water must

be made from a special high-grade varnish and contain little or no resin.

Satin finish is a peculiar enamel which dries with a satin-like surface, resembling polished ivory. In time it becomes as hard as ivory and may be used either as an exterior or an interior enamel.

This material is a recent production and was put on the market as a flat baking enamel. It is made by grinding zinc oxide in a lustrous varnish.

Cheap enamels are generally made with gloss oil or cheap resin varnishes; they work freely under the brush, level out perfectly and have a bright luster, but are not durable. If the dry surface of such an enamel be rubbed with the fingers for a few minutes the gloss is removed and the resin is reduced to a fine powder, leaving the surface flat and smooth. An intermediate grade of cheap enamel is made by mixing just enough hard gum varnish with the resin stock to prevent this pulverent action.

The manufacturer of enamels generally sells a "thinner" for reducing the goods, the object being to retain the luster when the thickened enamel is again reduced to a brush consistency.

These thinners are simply a mixture of turpentine and benzine, benzol, toluol, with just enough damar or white copal varnish to prevent flatting.

The thinner of a flexible enamel differs only from the above containing a linoleate in place of varnish.

The "flatting" of an enamel is due either to an absorbent under coat or to the presence of an excess of thinner.

The success of an enamel depends to a great extent upon the primer or under coat. A porous, *i. e.,* an absorbent, under coat takes up the varnish in an enamel in the same way that a partially dried under coat

allows the finishing coat of varnish to sink into it during the process of drying; consequently it is obvious that the beautiful luster or high gloss possessed by the enamels can only be retained by means of a perfectly dry and non-absorbent under coat.

This is not only true of enamels, but also of all varnish colors, lacquers, etc.

It is impossible to turn out a first-class job by applying a quick-drying enamel over a slow-drying or elastic under coat, as the enamel is sure to crack.

Where an elastic, slow-drying, durable primer is used plenty of time must be given to dry before putting on the second coat. As a rule each coat, from the prime up, should be a little harder than the succeeding coat in order to effect the contraction due to drying, and it is essential that the coat of paint next to the enamel be of a non-absorbent nature, otherwise the final coat of enamel will not have the desired "fullness" and luster.

Non-absorbent primers and second-coat paints are made by combining a little varnish and a very small quantity of drier with the oil; oil alone requires months of drying before it becomes non-absorbent.

Enamels are used on both metal and wood, the only difference in treatment being the under coats.

If the metal is tin, the grease, oil, resin, etc., must be removed with benzine or with a weak solution of sal soda (sodium carbonate); if the metal be zinc, then a wash with very dilute hydrochloric acid is needed to make the primer adhere; iron and steel require the removal of scale and rust previous to painting. Scale is removed by the sand-blast or by immersing the steel in "pickle," consisting of one part of oil of vitriol (sulphuric acid) and nineteen parts of water for about forty minutes; the adhering acid and scale are washed

off with water, the metal then rinsed in a weak alkali solution (sal soda in limewater), again washed with clear water, dried and then painted. Rust may be removed by means of the sand-blast, with a wire brush, or with sandpaper. The clean metal, after being primed, may be left to air-dry or may be baked; in the case of steel it is baked from two to four hours at a temperature of 220 to 240 deg., F., the result being a tenacious and very hard under coat. The second coat, if the work is to be white or light colored, may consist of a lead and zinc pigment with oil, turpentine, a small amount of varnish and sufficient drier to make the paint dry over night if the work is to be air-dried.

If the work is to be baked, the drier may be omitted and the paint is then given a two to four hour bake at about 180 deg., F. The finishing coat of enamel is generally baked two to four hours at a temperature of 160 deg., F.

Pale blue, light gray, pink, and similar delicate colored enamels are seldom baked at a higher temperature than 140 degrees to 150 degrees, F.

Baked enamel ware has a better luster, is much harder and far more durable than that finished with the same enamel and air-dried.

Small wooden articles, like tea trays, handles, etc., are often enameled by means of the baking process, but care must be taken that the temperature does not exceed 200 degrees, F., as the moisture is dried out at 200 degrees to 220 degrees, F., and the enamel ruined by air bubbles.

Wood-work, as a rule, is most frequently finished with air-dying enamel, and the method of treatment differs with the workman—some painters give a first coat of thin shellac, or a coat of varnish surfacer, followed with a second coat of flat lead and zinc, and a

final coat of high gloss enamel; others prefer to start with an oil paint primer, allow plenty of time for drying, then follow with a flat lead or lead and zinc second coat, after this is dry, several coats of polishing enamel are applied and rubbed down to a proper surface, the final coat of enamel being laid on this ivory-like surface. The final coat may be left in the "gloss," may be "flatted" by rubbing, or may be brought back to a high luster again by polishing.

From the above it will be noted that the cost of an enamel finish will depend upon the labor and the number of coats applied.

For a quick job it is better to give the bare wood one or more coats of "surfacer," sand to a proper surface, apply a flat lead coat, follow with one coat of polishing enamel, rub down, and apply a coat of finishing enamel.

In working enamels it will very often be found that on moist or muggy days the enamel is inclined to "pit" or to "frill," especially if the enamel contains damar varnish; this defect is invariably due to water. Damar varnish is cut cold in turpentine, and, as turpentine frequently contains more or less water, it often happens that the enamel is contaminated with the moisture.

By placing three or four sheets of gelatine in the enamel and leaving over night every trace of water will be removed by the gelatine absorbing the moisture. Gelatine is insoluble in oil, turpentine, benzine, and varnish, consequently will not affect the enamel.—*Scott.*

A First-Class Enamel Finish

See that all wood-work is well smoothed and without defects. Then prime with lead, adding a small quantity of ochre to slightly color same, reducing into

proper consistency with one-third raw linseed oil and two-thirds spirits of turpentine, with sufficient drier.

Second coat—Roughstuff the entire surface, filling and smoothing all defects in wood-work and rub down to an even and smooth surface.

Third coat—White lead mixed with three-fourths turpentine and one-fourth boiled linseed oil.

Fourth coat—White lead mixed with five-sixths turpentine and one-sixth white varnish.

Fifth coat—half-and-half white lead and "Green Seal" French zinc mixed with three-fourths turpentine and one-fourth white enamel varnish.

Sixth coat—Zinc as above mixed with three-fourths turpentine and one-fourth enamel varnish.

Seventh coat—All French zinc mixed with three-fourths enamel varnish and one-fourth turpentine.

Eighth coat—Enamel varnish with zinc sufficient to color the varnish and a very small quantity of turpentine to make enamel work freely. Sandpaper between each coat, to be done with very fine sandpaper or hair cloth. The first four coats to stand not less than three days between coats and the last four coats to stand not less than six days between each coat. All to be rubbed with pumice stone and water to a dull finish, and if a high polish should be wanted, polish with rotten stone and water after pumice stoning.

If wood-work should be of pine or any other sappy wood, give it a very thin coat of grain alcohol shellac after first coat.

An expert painter says a strictly first-class job of enamel white cannot be done with less than eleven coats, and he never would bid on work requiring less than nine coats. His last coating was finishing varnish, which was left in its gloss or polished to a velvet or

satin finish, as required. But it is rarer that more than five coats are required in specifications for new work, and less for old work. Some apply the shellac to the bare wood, the priming on this.

Another expert gives this as his method: Prime with white lead thinned with 3 parts raw oil and 1 part turpentine. The following three coats are made from zinc white in oil and from which the oil has been drawn by thinning with turpentine and allowed to settle, drawing off the liquid and repeating until all oil practically has been drawn from the zinc. The zinc is then mixed with damar varnish, which serves as a binder. If the finish is to be in any tint or color he makes the first zinc coat several shades deeper than the finish is to be, making each successive coat lighter in shade. Fifth coat is of color-and-varnish. For a white finish zinc white is used, mixed with a high grade white varnish, which has been made for such work. If to be tinted, then the zinc should be tinted before adding the varnish. The sixth coat is of this varnish, tinted with enough color to tint it. The work is then ready for the rubbing with pulverized pumice stone and water, followed with rubbing with powdered rottenstone and water. This for an egg-shell gloss. Further rubbing with rottenstone and sweet oil will give a polish. This process gives a very fine and durable finish.

Enamel Finish on Cypress.—Apply a coat of hot glue size, after which a priming coat of white lead thinned with three parts oil and one part turpentine, with a little driers. If the wood is very dark, as some cypress is, then add a little black to the priming. When quite dry finish up as directed for enamel painting. Where a dead finish is desired it is usual to apply the

glue size to the bare wood, but when the finish is to be a gloss then glue size on the priming coat. This latter glue size should be made from white glue with some dry zinc white added, and be made rather thick and applied hot; when dry sandpaper smooth.

Notes on Enamel Paints

Some use crude oil when rubbing enamel to a polish, but it is apt to soften the varnish and soil the work.

To enamel over old paint it is best to remove the last coat of old paint, if not the whole coating.

Enamel paint is better for having some age before being used; a fresh-made enamel paint is apt to work rather thin, show brush marks and not flat out well. But if kept too long it is apt to be too thick and work ropy. In this case try immersing the can of enamel paint in warm water before using. If it has to be thinned, then use a mixing varnish, supplied by the maker of the paint.

The less oil in the undercoats the less the danger of yellowing of the finish.

Enamel paint naturally works rather hard under the brush, owing to the varnish in it.

Quick-drying enamel paint works hard and does not wear well. It is impossible to produce a quick-drying enamel that will prove durable.

A quick-drying enamel paint should have pigments ground in turpentine and thinned with gold size, and may be safely used after the priming coat, on new wood, or for all coats on metal. But for old painted work such an enamel paint will be apt to crack. On such work the egg-shell ground is best.

An enamel paint that is to be exposed to the weather must dry rather quick, give a hard surface, yet be elas-

tic enough to contract and expand with the weather without cracking. The enamelled surface must be quite smooth and glossy. Exterior enamel paints dry somewhat slower than interior enamels, since a more oily varnish is used, in order to make it more elastic, and here is where the trouble comes in making the right enamel, it must be elastic yet not too oily, for in the latter case it would remain soft. The other extreme will cause the enamel to crack and to leave the surface it is applied to.

The addition of a tablespoonful of coal oil to the gallon of enamel paint is said to make it work easier under the brush, without injuring its luster.

Or thin out with benzine, which will allow of easy spreading and not injure the gloss, as the benzine evaporates and leaves a thin coating of the original enamel. This method avoids laps in the paint, too.

Camphorated turpentine, made by dissolving two ounces of gum camphor in one gallon of turpentine, is an improver, as given in the following formula:

FORMULA FOR WHITE ENAMEL.

Florence zinc white.....5 lbs.
White damar varnish.....1 gal.
Thin with
White enamel varnish.....1 gal.
Camphorated turpentine.....1 pint.

PAINTING SMOOTH OR HARD PLASTER WALLS

EW WALLS.—New plaster walls contain excess of lime, the white coating consisting of plaster of Paris, a small proportion, and fresh slaked lime. This excess of caustic lime will injure any oil paint placed directly upon it unless the surface has been allowed to stand untreated for two or three years. Even then it is not safe. This lime may be neutralized by a size containing a gill of muriatic or hydrochloric acid to the bucket of water. The acid forms with the lime hydrochloric acid gas, which evaporates, leaving on the surface of the plaster sodium hydrogen sulphate, which may easily be removed by means of clear water.

Having "killed" the free lime, the next step is to stop all suction, and by this we do not mean the making of a perfectly solid surface, for a little porosity is desirable, enabling the paint to secure a good hold on the plaster. W. Fourniss, an expert English painter, says that "for paint there should be absolutely no suction," with which statement I do not agree, for the reason given. To stop, or stop to a desirable degree, this suction we may use glue size, provided there is absolutely no dampness in the wall or surroundings. In case of dampness it will be best to size with a thin lead paint, thinning with raw oil and a little turpentine, to assist penetration. This coat may be tinted to agree with the color of the coats that are to follow. Use not above five pounds of white lead to the gallon of thinners, and brush the paint well into the plaster. If the weather or room is a little cold, warm up the priming coat, before adding the turpentine.

Some painters apply a coat of glue size after the priming coat is dry, using good white glue, a pound to the gallon of water, which would be a pretty strong glue size. The argument is, that this will save one coat of oil paint, and stop all remaining suction. We do not recommend the practice, excepting upon the score of saving, when it is a low-price job. For a strictly first-class job use oil or oil and turpentine paint all the way through. The glue size, it may be added, is to be applied quite warm. Upon it you may apply a coat of oil paint, mixed rather stout, and be well brushed out. Thin it with a mixture of three parts raw oil and one part turpentine. If the size has been omitted, then the coat on the priming coat will have to be mostly oil and not too stout, for it will have to enter the surface to a certain degree, saying that the priming coat did not fill up the pores perfectly. The third coat should be of white lead thinned with turpentine, and no oil. Mix it moderately stout, so that it will cover well. This assuming the finishing is to be flat.

In hot weather the flat paint is apt to work hard under the brush, in which case add a little raw oil.

For an egg-shell gloss finish thin up the last coat with a mixture of one part raw oil and three parts turpentine.

For a full gloss finish bring the under coats up with plenty of turpentine in them and the last coat should be mixed in all oil, a full gloss being best attained when the surface under it is flat. Boiled oil will give a better gloss than the raw oil. Never apply an oil finish on an oil coat if you desire a full gloss.

If the last coat is to be stippled, proceed as directed elsewhere for that work.

Where color is used, color each coat a little different, so that, for instance, if you make a coat very light gray, you will easily perceive where any miss may be made.

A master painter who did the painting on the walls of a state capital building, says white lead should not be used for the priming coat. He applied the first two coats from a French zinc ground in poppy oil.

An expert is quoted as saying: "If I were given a *carte blanche* order for the painting of plastered walls, I would first have the walls well glued, sized and covered with muslin or a light canvas, allowing about 24 hours for drying, or until the dampness is thoroughly dried out. For the first coat I would use pure white lead and oil, with enough japan drier to set it well. This coat should be rather thin. I would follow this with two coats of lead, oil and turpentine, using almost one-third turpentine. If weather conditions are good allow 24 hours, as much depends upon the drying of the various coats of paint. Then comes the fourth or final coat, which should be mixed with white lead and turpentine, using a small amount of drier. This final coat should be stippled to a nice even finish, and sometimes a stippler is used on the third as well as the final coat, as this does away with all brush marks, and leaves a nice flat-finished wall. If a clear white is required, use zinc in place of white lead for the last coat. This, if handled by experienced men, should make a first-class piece of work, and being covered with muslin, there will be no danger of the plaster cracking."

To paint a wall pure white is not usually thought to be very feasible, but it can be done by the following method. It will be white and stay white, bearing wash-

ing, too, without any bad results: Take zinc white ground in oil, and beat it up to a paste with benzine, then set it aside until the oil and benzine comes to the top; pour off this liquid, and mix up the zinc with turpentine, adding a little varnish to bind the paint. For the second coat wash the zinc twice with benzine and then thin up with turpentine only. Zinc in oil will turn yellow, the same as white lead does, but by drawing off the oil you get a whiter job, and one that is more permanent than either lead or zinc would be if oil is allowed to remain in it. For driers use white japan. Those who have tried it say that a better flatting can be had by adding a little water to the paint, stirring it in thoroughly. It is better to add the water to the white lead before beating it up, just as it comes from the keg. This can be done by adding the clear water very gradually, until it combines with the lead. Then add any desired tinters and thin out with turpentine, adding a small quantity of driers.

It is claimed that this water will in no wise injure the paint or the finish, evaporating after a while.

"If a wall is to be finished in stipple, mix the last coat half oil and half turps, rather thick and add a little japan. To stipple, strike the paint evenly and continuously with the square end of a large brush, made for the purpose; a new, clean duster will do. Let the stippler follow the painter.

"Use boiled oil in all coats except priming coat. Have only enough difference in the color of the different coats so you can see where you have painted, as it will help you, especially in rooms where the light is poor.

"It is poor policy to paint a plastered wall until it has had plenty of time to thoroughly dry out. If, how-

ever, the painting must be done before the lime has become neutralized, give it a coat of vinegar and let it stand a day or so before you put on the priming coat." —*Carter Times.*

On some walls a priming composed of equal parts of red and white lead, thinned with boiled oil, and made quite thin, will do best, as it will enter the pores of the plaster and give a good firm foundation for the painting. It is hardly necessary to add that it should be rubbed in well, for this is necessary in almost every kind of painting.

"The best, but more expensive way of preparing a wall for oil is to have the wall covered with muslin, or, still better, prepared canvas. In hanging canvas many precautions must be observed, namely, that no blisters remain, no ridges from paste being spread unevenly, and most of all, no laps. Cut your canvas at all corners and angles and join up very closely in these places. For a straight run keep the edges about one-sixteenth of an inch apart; when dry, fill up all seams, bad corners and angles with a composition, consisting of half turpentine and half interior varnish. Add whiting as a body until it forms a heavy, soft putty, using a putty knife or scraper to fill such places. This mixture will dry in ten to fifteen minutes. Then go ahead using oil color, as described above, next day."—*Anon.*

"Varnish, hard oils, liquid fillers, etc., are frequently used as sizes where walls are to be painted. These stop suction, dry quickly and at the same time save one or more coats, but cannot be recommended on good jobs for this reason—they dry too fast, have not

enough oil to penetrate the plaster, and in some instances give cause for peeling and cracking.

The cause of peeling and cracking, according to my knowledge and experience, is this: In some instances this size will dry too fast, especially on hot days, and the liquid that is used for thinning is evaporated and the varnish is dry before it has a chance to penetrate the plaster sufficiently to get a good hold. It merely remains on the surface, and in order to get good results the material applied should be where it does good."

"When I do work of this kind I always use oil paint all the way through. For the first coat I use whatever old paint I have in the shop, using turpentine for thinning; no driers, having paint rather thin, allowing same plenty of time for drying. For the second and following coats of paint use two-thirds oil and one-third turpentine, and if a flat or dead finish is wanted the coat previous to the final one should be in gloss finish, and if a gloss finish is wanted a flat coat is used." —*Anon.*

"To begin with hard plastered walls, you must examine the plaster, clean the same from all blemishes, give it a thin coat of oil paint, not too fat; if oil paint is used, thin well with turpentine; after applying, leave stand two days; this will show fine checks. Give the same a light coat of glue size, let stand until next day; then give it one coat of lead, oil and turpentine, properly mixed; stipple lightly, let stand twenty-four hours, then give it another coat to any finish that you may desire, such as gloss, semi-gloss, egg-shell or flat finish. For egg-shell, use pure lead, two parts of linseed oil, six parts turpentine and a little drier, then stipple.

For flat finish, use pure lead and turpentine and stipple; if dead flat is wanted, add a handful of dental plas-

ter. This will absorb all the oil and make it dead flat. Never use glue size first on plaster, for this is apt to peel, but by first painting the wall one coat of oil paint, then a coat of glue size, this can never peel and will stop the suction of the little check cracks."—*Anon.*

Painting Over Patent Plaster.—The composition of what we term patent plaster is not generally known to the trade, nor can we give its secret of manufacture, but we do know that it is a very treacherous material to paint over. Some say it contains a very strong acid, and that it has been known to eat through metal lathing. If this be true, it is no wonder paint finds it antagonistic. Yet it has been found that where such a surface as patent plaster has remained unpainted or unpapered for a year or two there was no difficulty in getting a good finish.

Inquiry of several paint makers as to the best means for neutralizing the antagonistic properties of patent plaster resulted in the obtaining from the chemist of one concern the following test for ascertaining the presence of an acid. It is likely that the acid in the plaster is citric, the purpose of which is to retard the setting of the plaster. Here is the test:

Make a solution of one dram of phenolphthalene to one pint of fifty per cent. grain alcohol, then add a pinch of concentrated lye. This solution will be a wine color, and when applied upon the wall in small patches with a camel's hair brush will turn white directly if acid is present. In order to prevent the action of this acid upon colors in kalsomine, paints, wall paper or textiles, apply two coats of the following solution: Eight parts of water to one part of strong ammonia, the second coat not to be applied before the first is thoroughly dry. When the second coat is dry,

apply the size. When ceiling varnish is used it should be reduced one-half with turpentine or benzine, with the addition of enough plaster paris to give the walls a tooth.

"The question sometimes arises as to how best to finish a newly plastered wall that is to be painted so that the color may remain permanent. If the painter can control the plasterer, he should see that either Keen's or Parian cement is used for the final coat, and should arrange to apply his first coat of paint immediately after the plaster is in a condition to permit of the brush being drawn across it. The theory is that the paint combines with the plaster while it is setting and, in this way, forms a hard foundation for the subsequent coats of oil paint. The same result is by no means produced, if the paint is applied even a day or two after. It must be put on while the plaster is practically wet. Very little oil is required in this first coat, which should dry practically without gloss; two, three or four coats of oil paint should then be put on in the usual way. The same preparatory work will answer for a first-class job of distempering"—*Anon.*

Now, as regards the cracking of the paint and plaster, if the plaster has been properly troweled, it will not show the so-called fire-crack. Moreover, uneven troweling causes uneven suction, and for that reason paint never dries out uniformly until one or more coats have been applied to overcome all suction, or the walls sized.

Often the paint is applied before the plaster is properly dried out, and the moisture in attempting to escape must necessarily force the paint off the walls, because the moisture cannot get through the paint.

Very often the plaster is put directly on the brick walls or on wire lath, which lays directly against the brick, stone or cement which compose the wall; in either case, there being no air space between the wall and the plaster, any saltpeter in the bricks, stone or cement will feed out through the plaster, and every painter knows what saltpeter means. Saltpeter never exists in plaster. It can only come through the plaster in some such way as shown. Saltpeter is the bane of painters. It is really not saltpeter at all, but sulphate of soda, or epsom salts, and works its way through to the surface of whatever porous material it may be present in, and at the surface it loses its moisture, becomes a powder and discolors the paint, eventually causing the same to crack and peel off.

No efficient remedy has yet been found to overcome the effect of saltpeter. The only way its presence in the plastered walls could be prevented is in the construction of the walls themselves, by leaving sufficient space between the plaster and the bricks, etc., so the saltpeter could find a vent without going through the plaster. So far no treatment of the saltpeter itself has been found effective.

Painting Old Hard-Finished Walls.—Treat old walls the same as new ones, if the walls have never been painted before. If the walls have been painted the most difficult and tedious task is the filling of cracks and holes. These cracks should always be opened down to the lath, soaked with water and filled with plaster of paris, a little above the wall. When dry, sandpaper down until they are flush with the wall. Then build up these patches with paint until they have the same body as the old wall, color to be about the same shade as old color on wall; then paint your wall

all over two or three coats, as required, treating same according to its finish, either gloss or flat.

Suppose the wall has been painted before and the old paint is peeling off in blotches. Scrape off all the loose paint, sandpaper the wall, and give same one coat of paint thinned mostly with turpentine, using a little drier. When dry, make a mixture of one-half turpentine and one-half rubbing varnish, adding enough whiting to make it the consistency of soft putty, and fill the blotches with this mixture, using a putty knife or scraper to do so.

A second coat of this material may be required, then sandpaper and build up these blotches with paint until the surface is the same as the old wall.

Here is another mixture: Make an ordinary paperhanger's paste, using wheat flour. When cold, add whiting until it is heavy as keg lead; run through a paint mill, or if no paint mill is at hand, work same with a spatula or scraper, until it is free from lumps; then make another batter of oil, with a little drier added. Mix same with whiting until it gets like heavy gravy, then run through mill. Mix these two batters together in equal proportions. Apply this in the same manner as the former, also give the same treatment afterwards as recommended above.

The last mentioned filler or roughstuff (you may call it whatever you choose), can also be used for ordinary work on any kind of wood, both inside and out.

If paint is peeling off, or if blisters are present, I never use a paint burner, but always use the above-mentioned filler. It can be mixed in different ways for different purposes, but as I cannot describe this under the head of this paper, I will be glad to give you an explanation later on, both as to how to mix in dif-

ferent proportions and for what purposes it may be used.

Bathroom Walls.—New walls are treated the same as in other rooms, though some first size them with boiled oil or a thin drying paint, following with a coat of glue size. The object of this careful sizing is to fill up any soft or spongy spots, making a uniformly hard surface. Follow with two or more coats of oil paint.

Oil paint or varnished surface is best for the bathroom, owing to the fact that water and soapsuds are apt to get on it not infrequently, and such a finish allows of easy cleaning.

Old work should first be made clean, with such substances as soap or soap powder, or any not too strong a cleanser that will remove dirt and stain and leave a fit surface for paint. Following the cleaning, if the walls are very dirty, and particularly if soda has been used, wash off with clear water and do it before the soda water has dried.

After the washing of the walls it is well to let them dry for at least twelve hours. When dry give them a thin coat of fresh slaked lime with a fairly good amount of alum mixed with it.

The alum, to work properly, should be dissolved in hot water. Before applying the size coating, care should be taken not to allow it to come into contact with the lime wash until the lime wash is thoroughly dry, as the lime will immediately destroy the strength of the size. The size coating should be made of whiting and of a good glue size. If there are stains which are impossible to take out, a thin shellac varnish may be applied previous to putting on the finishing coats of paint.

Cleaning Walls.—Walls that have been painted can be cleaned, provided the paint has not begun to perish. In cleaning a painted wall it is best to have two men working together, one following the other. In this way there is not much risk of spotting or streaking. A stretch of three or four feet is as much as should be done at a time. First, dampen the wall with a sponge that has been saturated with clean water. Follow this with soap-suds from castile soap and warm water, and apply same with a calcimine brush, scrubbing a little. When the dirt has been softened in this manner, scrub with a solution made by boiling the shavings of one pound of castile soap in a half gallon of water, stirring in two pounds of fine bolted whiting, and allow to cool. Dip a brush into this mixture and scrub, taking care not to scrub harder than is required to remove the dirt. Sponge off immediately with clean, soft water and wipe down with a wet chamois that has been wrung out. Care should be taken that too much water is not used on the wall. The sponge and chamois should be wrung out as often as possible and the water changed quite frequently. The work should be started at the bottom and continued towards the ceiling. The ceiling is then cleaned in a similar manner.

For a dirty wall, before painting, apply a coating of raw starch water, which, when dry, may be brushed or wiped off. This is specially good for walls dirty with soft coal smoke. When the walls or ceilings are smoky, a little household ammonia added to the soap-suds will add to their efficiency in removing the dirt.

For a greasy wall that is to be painted, scrub well with strong vinegar. A thin coating of fresh lime wash is good for a smoked wall.

Wall Defects and Their Treatment.—Where plaster is placed directly on a brick wall and the latter

is more or less damp, the alkali of the lime will come through and cause spotting. The spots will in turn come through size and paint, and the only sure remedy is to scrape down the spots to the plaster, and cut out bad spots clear to the bricks, then fill the parts with plaster of Paris, pressing it well into the depression and a little above the surrounding part. Over this may be applied hard white lead putty, merely glazing it over, first, however, having sandpapered down the plaster level. The hard putty is made from white lead in oil, rubbing varnish and a little turpentine. When this putty coat has become hard sandpaper it. Then apply a priming coat of white lead made thin with raw oil three parts and turpentine one part, with a little driers. When dry apply a coat of glue size, and then the finishing coats of paint, whether oil or flat.

So-called saltpeter spots on walls have been successfully treated with coal oil or kerosene oil, and let the oil dry, as it will in process of time. Then apply a coat of flat paint. Then size with glue size, rather thin, which follow with another coat of flat paint.

Some prefer lime and plaster of Paris putty to repair wall cracks with, and Keene's cement or Parian cement are good. But Keene's cement must be painted over within twelve hours of application.

Where the ceiling and walls are to have two coats of paint, and the surface is full of small cracks and big, and where there are also uneven places, as so often occurs, try the French method. Mix dry white lead and coach japan to a stiff paste, and with this plaster over the parts needing it, using a broad knife and making the surface smooth and level. When dry, sandpaper smooth and level. This plaster will not absorb the paint any more than the rest of the wall.

The walls which for the first time are to receive their paint should have, for the first coat, boiled oil or a coat of drying paint, and then a thin coat of size. This will prevent the showing of any sponge spots that there might be in the wall. After this, one coat of paint may be applied, and then when this coat is dry we can apply our finish coat.

Spots of a brown color on walls plastered directly on the brickwork are sometimes due to dirty or sooty bricks—either old bricks from chimneys or bricks that have been directly exposed to the fire while being baked in the kiln. The only satisfactory way to cure spots due to this cause is to cut out the dirty bricks and replace them with clean ones. The writer has seen a spot from a sooty brick come through a four-inch marble slab and permanently discolor it.

Painting Over Calcimine.—If the calcimine coating is in good condition it is safe to paint over it. Add plenty of turpentine to the first coat of paint, so that the paint will sink well into the calcimine and hold there. The calcimine does not require sizing before painting. If the calcimine is not in good condition it will be better to size before painting, using a size of cheap varnish reduced with benzine. Or with equal parts of oil, turpentine and japan. Or with gloss oil.

Painting on Stucco.—For exterior stucco work, you first clean off the work, then prime the same with a paint made of equal parts of white lead, red lead, and boiled oil, all by weight. The second coat should be made from white lead, thinned with boiled oil, with stainers to make the color desired, and about half as much turpentine as oil. A third coat of this paint may be given, and for extra good work apply still another

coat, only you will use more oil and less turps in the last coat.

How to Avoid Laps In Flat Painting.—Where a sufficient number of hands are at work, dead flat painting may easily be done, but otherwise there is danger of laps. To avoid this an expert advises the addition of a little varnish in the last coat, and have a man to follow after the brush with a stippler, so that laps will be impossible.

Finishing a Plaster Wall In Flat Oil Paint.—An association of master painters adopted this as the best method for finishing a hard finish plaster wall in flat oil paint: Fill all cracks, then sandpaper. Prime with a paint made from 5 pounds white lead to a gallon of thinners, driers not being named. When dry, apply a coat of hot glue size, well rubbed in. Then coat with paint made from white lead of medium consistency, thinned with equal parts of oil and turpentine. Tint this coat to agree with what the finish is to be. Next coat, white lead tinted and thinned with $\frac{1}{4}$ oil and $\frac{3}{4}$ turpentine, tinting it a little darker than finish is to be. This coat is also to be stippled. Then apply the final coat, made from $\frac{3}{4}$ zinc white and $\frac{1}{4}$ white lead; stipple this also. Lithopone may be used instead of lead and zinc for the last coat. While no mention is made of the driers in any of the coats, we may assume that some was used in all, though it is always best not to use much in the priming coat.

Where an extra fine finish is desired, it is necessary to make a smooth and level surface. Apply a coat of whiting calcimine, rather heavy, and sandpaper down even and smooth. This will fill up cracks and all irregularities and make a good ground for a finish, especially for gloss or enamel finish.

If you have a highly decorated wall and find it glossy in spots, give it a coat of starch, or the water that is pressed out of cottage cheese; this will make all colors flat.

Dead Flat Effect In Wall Painting.—A wall that is not very uniform and good may be painted and finished in oil color, showing many fine dead-flat cracks, but if a coat of starch is applied as a finish it will cause the entire surface to appear dead flat and uniform, no streaks or lines showing. This coating is to be stippled, which makes the effect still finer. Then whenever desired, this coating may be removed by washing, and another coat applied, and in this way the freshness of the original paint is retained indefinitely.

Another way is to add a very small amount of beeswax to the last coat of paint, melting it in the oil used in thinning, which will leave a very fine waxy, semi-dead finish.

Buttermilk is another good preparation, though all particles of butter must first be removed from it. Skim milk is perhaps even better still. Sweet milk also answers. The buttermilk should be strained. These coatings may be applied by means of a calcimine brush.

When using cornstarch for this purpose it is prepared just as for laundry purposes, and it must be stippled to get the best results.

Painting Sand-finished Walls

New Walls.—First, examine walls for cracks and other defects. Sand-finish walls vary from fair to bad, and hence must be prepared so as to form a solid surface, in all cases. Open up cracks and wet with

water, then fill with a plaster of clean sand and plaster of Paris. Then trowel it down, smooth, using plenty of water and a cork trowel, if possible, otherwise a wooden one, or "float." The trowel will bring the sand to the surface, imitating a sand-finish. If the wall is very rough it will be best to go over it with coarse sandpaper or a brick, to knock off the roughest parts.

The next step is to size the wall. Some use this size: Gloss oil two parts, benzine one part, adding plaster of Paris to form a suitable coating. This stops suction and fills the pores.

If the walls are rough and full of hollow places, give same a coat of strong-sized calcimine, after which apply paint made of oil, turpentine and white lead.

Some object to glue or similar sizes, saying that they do not give as great stability, and they use lead and oil for size, saying that a job built up from the sand-finish with lead and oil and necessary turpentine will have "life" and will last longer.

Where the price is low it will be best to size and fill up the surface with calcimine, made with glue and whiting, plenty of glue, say an ounce to the pound of whiting, or even more than this, up to two ounces.

After the wall has been properly sized and filled the finishing is the same as though working on wood. But owing to the roughish finish it is not feasible to get the same effect as on wood and smooth hard plaster, hence it will be well to remember this.

Regarding style of finish, this may be plain or more or less fancy. You may finish in white or color or tint, and the last coat may be dead flat, lead and turpentine, or full oil, or egg-shell gloss. If deep, rich colors are desired you may glaze on the proper ground

color and have blended effect, mottle effect, clouded, leather, or fabric effect.

Sooted or damp walls must have proper treatment, for which see under appropriate head.

FLAT WALL PAINT

PREPARING THE SURFACE.—No question that has arisen in regard to the use of flat finishes has aroused more discussion than the treatment of the walls before applying the finish. It is pretty generally conceded that new walls should first have a priming coat, the vehicle of which is largely linseed oil, and most manufacturers put out such an article for use as a primer, or give directions for its preparation. In the case of old walls previously painted, there is not such unanimity of opinion. The dangers that follow the bringing together of white lead and lithopone have been too much enlarged upon, and in some cases grossly exaggerated. There is no danger in applying lithopone over a dry coat of white lead, or *vice versa,* as far as any reaction between the two pigments is concerned. Some painters have even made outside paints in which the essential pigments were sublimed white lead and lithopone, and claim good results. Where the modern flat finishes have not worked properly over old flat lead paints, we must look for some other cause than the antipathy of lithopone and lead. It is my opinion that where trouble has been experienced it has been due almost entirely to the poor physical condition of the old dry coat. It is impossible to get much oil into a lead coating, and at the same time have it flat. Such coatings are, therefore, deficient in binder when applied, and become more and more brittle as time goes on from saponification of the oil by the lead, and possibly through reaction with the lime of the wall.

The same coating applied out of doors would rapidly check off, and would practically have disappeared by the time the surface came up for repainting, but with indoor exposure only it remains on the wall, though none the less perished and dead.

Such a surface is unfit as it stands for supporting a finishing coat properly, whatever may be the pigment in it. It greedily absorbs the vehicle from the new coat, but not equally so over the whole surface, leaving the latter of uneven luster and more or less deficient in binder. The new coat may check, or in some cases may pull the old dead coat off. Two coats of flat finish will be needed in all such cases to get a uniform looking job, and if the first of them is liberally thinned with linseed oil so as to add some life to the undercoat, the job will be the better for it.

It is manifestly impossible for the manufacturer to cover in his directions all the cases that arise in practice, and specify the treatment for each. More depends upon the man who applies the paint than upon the paint itself. It is with a finishing coat of paint as with varnish—it is the last thing which goes on the job—and if the results are unsatisfactory the unthinking man is apt to blame the finishing coat, whatever it may be. The careful painter looks well to his foundation, and this should be the watchword when using modern flat wall finishes.

In securing a satisfactory job with flat wall finishes built up with lithopone, much depends upon the preparation of the wall or surface. Unfortunately, the plaster on walls, especially the sand-finished kind, is not uniform—the hard spots holding up the wall finishes and the porous parts soaking it in. Glue size, while permissable under calcimine, is undesirable as a means of holding up flat wall finish. Either the var-

nish content of the wall finish, drying hard, causes the glue to curl and peel, or the water, after continued washings, goes through the porous paint coating, softens the glue with disastrous results. Gloss oil should not be used, as it does not resist moisture. A good, free-working varnish size, consisting of a gallon of varnish to which a quart of flat wall paint has been added, will be found thoroughly satisfactory.

LITHOPONE.—The two raw materials which are used for making lithopone are zinc metal, or spelter, and barytes. The zinc is brought into solution and the barytes is furnaced and converted into a clear, transparent solution of barium sulphide. When these two solutions of zinc sulphate and barium sulphide combine, the two metals, zinc and barium, exchange their acids.

The soluble zinc sulphate is converted into insoluble zinc sulphide and the soluble barium sulphide seizes the sulphuric acid from the zinc sulphate and is converted into insoluble barium sulphate.

Research laboratory work has proven that the resulting article is not a mere mechanical mixture of zinc sulphide and barium sulphate, but a close molecular mixture, so that we have the new product which we call lithopone.

The precipitated lithopone is dried and then ground in wood oil. In some lithopone factories the lithopone is thrown red-hot from the calcining ovens into cold water. It is supposed that it thus acquires a finer grain and more body, but this appears to be a mistake, and the practice necessarily involves a second filtration. The sulphide of barium used is seldom made from precipitated sulphate of baryta, and nearly always from the natural salt, heavy spar or barytes.

Flat wall finishes are all made on the same fundamental formula; the essential pigments are lithopone and zinc oxide with or without inert pigment and with the addition of the ordinary colored pigments in the tints and shades.

As undercoating for enamel they will be found useful, owing to the ease with which they may be sanded. On steel ceilings they will be found to be just as satisfactory as on plaster or fibre board. They produce a very pleasing effect when applied over burlap, the latter being first treated with a coat of a good liquid filler. They may be liberally thinned with turps or benzine and applied to window shades to restore the original color or to change the shade to conform to a new color scheme in the room. For finishing radiators they are excellent, as even the white and light tints show little tendency to change at the temperature of hot water and low pressure steam.

It should be understood that while lithopone can be used very extensively in interior painting, it cannot be used in the same way as carbonate of lead or oxide of zinc, but must be used with more or less discretion and knowledge of its nature, otherwise the painter is apt to get into difficulty. For instance, green or chrome yellow, which the painter uses generally, is made from a lead base which will work with oxide of zinc or carbonate of lead without detriment, but cannot be used with the proper degree of safety in lithopone. In all cases where a green or yellow is to be used it ought to be a chromium oxide or a mixture of zinc yellow or cobalt blue. These particular colors are, of course, lime proof and are superior for interior work or cement work, and should always be used in connection with lithopone.

Notes on Use of Lithopone Wall Paint

Lithopone paint does well enough over white lead, but some advise against the practice.

Not more than 15 per cent. of benzol should be used in thinning out lithopone paint in paste.

It is best to flow on lithopone paint rather more freely than white lead paint.

Try adding tablespoonful of raw oil to the gallon of lithopone paint, if it dries so fast as to show laps; this will make it work easier under the brush.

The addition of pure raw linseed oil is desired in lithopone paint.

Flat wall finish should be applied much as you would calcimine, no care being taken to lay it off as oil paint is laid off. When dry it will present a smooth flat surface free from laps and streaks.

Cracks, etc., filled with plaster, should be shellaced over and allowed to dry before sizing walls with varnish.

The best flat wall paints do not set too quickly, and one man can manage a surface that with flat lead would require at least two men.

One may get over ground faster when using flat wall paint because wider brushes may be used than with white lead.

It is feasible with some brands of flat wall paint to touch up missed or defective parts long after the surface has been coated, without showing the touch-up.

Never putty with common glaziers' putty, for the same will show up under lithopone paint; make the putty from dry white lead, whiting and gold size, as per formula for putty under proper head.

Never coat a damp wall with lithopone wall paint, for it will not do. If a damp wall has been so coated, then paint it over with white lead paint.

Use same pigments with lithopone paint as with lead and oil paints, but zinc yellow and ultramarine blue are better than lead chrome and Chinese blue, respectively.

As liquid driers contain lead they cannot safely be used with lithopone.

When flat wall paint does scale from a wall it leaves it in sheets.

Lithopone paint mixed in oil will last almost as long as white lead paint.

Flat wall paints are variously made, some good, others not.

It is the whitest paint known, and will cover a black stove with one coat.

With lead it will darken. Testing 21 samples, 18 darkened, and only 3 stood up without darkening.

Lithopone is cheaper that white lead, easier under the brush than zinc white, and is non-poisonous.

Prussian blue and chrome yellow should not be used with lithopone, as they will darken the paint.

Some brands of lithopone wall paints are mixed with water, and this kind should not be used. Some lithopone paints contain no lithopone at all.

To tell whether a wall paint made from lithopone will turn, coat a piece of board with it and expose it to light in a window in comparison with some other paint.

Lithopone has remarkable hiding or covering power, relatively low oil-carrying figure, lack of brittleness, and a peculiar texture that when ground in oil makes it flat easier than other white pigments.

Hot-pressed oil almost invariably gives a pigment which turns brown in a few months. In this tendency to turn brown we have the sole drawback of lithopone.

Brushing out of flat wall paint should be avoided; it results in a great saving of time and labor in the work.

A painter says he adds a little varnish to flat wall paint and that it "works fine."

Regarding Its Toxic Qualities

There is absolutely no poisonous matter in the pigments. The liquid is universally a flat drying china wood oil varnish (in its essential composition) identical with most of the better grades of varnish ordinarily used by painters. There is nothing volatile or poisonous in such a varnish subjected to the heat of manufacture.

The volatile thinner is almost universally asphaltum spirits—that is, a heavy benzine with a high boiling point. The trouble comes from this ingredient, if it comes at all.

Doubtless the inhalation of benzine vapor in a closed room will produce the phenomena of ordinary smothering—insufficient oxidation of the blood; but it will not do so as quickly as the more volatile benzine ordinarily used by painters; nor will it produce the serious toxic effect of turpentine vapor inhaled in similar circumstances.

All painters, everywhere, constantly use paints and varnishes containing large percentages of the volatile thinners above described and all painters have heretofore habitually used white lead "flatted" by themselves by "washing out" a proportion of the oil with turpentine. They also frequently use the still more toxic wood alcohol in shellac varnishes, where it is employed as a denaturant of ethyl alcohol.

Any and all of these materials can, when used without ordinary care, produce disagreeable effects, and

some of them, especially wood alcohol and turpentine, may involve serious consequences; but the least dangerous and the least injurious of them is the heavy gravity petroleum spirit used in flat wall finishes. This product is safer than the rest, not only because it evaporates more slowly and its vapor, being heavier, flows away more rapidly, but also because it is actually less toxic than the rest.

The remedy is ventilation—the ordinary natural ventilation dictated by common sense. If this be provided no ill effects can possibly accompany the use of these finishes. Furthermore, under duplicated conditions, they are less injurious than "flatted" lead, ordinary high-grade paint or first-class varnish.

Merits of Lithopone Wall Paint

Lithopone is more opaque, it obliterates better than white lead, therefore, for covering up old discolored white or pale tints, it is more effective, and two coats may serve where three of lead might have to be used.

It is whiter than white lead, and retains its whiteness when properly mixed with the correct drier and oil for far longer periods than white lead, and when delicate tints are required it gives purer tones than lead, and these in turn retain their pure tones longer than if made with white lead.

It works as freely as lead, and follows the brush more like lead than oxide of zinc does.

It is lower in initial cost per hundred weight or per gallon than lead, and when the strong points I have enumerated are taken into consideration, it must be admited that it is a desirable article for painting purposes.

The pigment is not brittle, and if any flaking or inelasticity manifests itself, the fault is said to be in the

binder. It is more elastic than zinc oxide and is not discolored by sulphurous gases, as is white lead.

The tendency of lithopone paints to flat is particularly valuable to the master painter for flat work. Because lithopone requires to be carefully ground in the proper percentages of certain reinforcing pigments, its use in the dry form by the master painter cannot be recommended.

Thorough grinding of the ingredients is necessary for the best results, and therefore lithopone products have thus far only been offered to the master painter either in paste form, similar to lead in oil, or mixed ready for use. Either form has much to recommend it to the practical painter and decorator, and his choice depends dargely on conditions governing the work in hand. Furnished in paste form, ground in oil or varnish, or both, it can be thinned with volatile thinners to make a perfectly flat job, and can be tinted, as in lead to the shade required. In thinning paste goods with naphtha, which can be used wholly or in part with turpentine, it is advisable to use the heavier naphthas, or if these are not available, to add a pint or less of good, clean petroleum or coal oil to each gallon of naphtha to slow its evaporation and decrease the flowing properties of the goods. This does away with the piling up or ridging so common in flat work. If the thinner added to the paste dries too slowly, gasoline may be added.

In connection with the production of a flat paint it is well to bear in mind that lithopone will stand a greater amount of elastic binder in the vehicle, and still flat out, than other white pigments. Any of the white pigments may be ground in coach japan or japan and varnish, and produce a flat paint when the paste is thinned with volatile thinner, but the film so produced

is not an elastic film, such as is produced when the binder is oil. It is generally necessary to stipple a flat white lead job, even though the lead has been drawn with turpentine and a considerable part of its oil removed; but lithopone, even though it takes relatively more oil in grinding than lead, will flat so perfectly that no stippling is necessary, even though all the oil used in grinding is allowed to remain.

Any additional care or expense involved in preparing a satisfactory foundation for the application of flat wall finish is more than offset by the fact that stippling is not necessary; the brushing is done much quicker; a wall finished with it can be washed a greater number of times than a lead-coated wall and without showing streaks and blotches, and when once a wall is coated with it, no special preparation is necessary beyond the usual patching and sizing incidental to the natural wear of the building, before flat wall finish can be applied again.

Lithopone is finer and shows more absorption for oil than lead does, but not as much as zinc.

Lead, 100 pounds, contains about four gallons oil, while 100 pounds of lithopone is said to contain eight and one-half gallon oil.

Lithopone of the best quality is lighter in gravity, and much bulkier than white lead. Ground stiffy, it will absorb much more linseed oil, and will require a much larger container, owing to its much more bulky character. When mixed to a ready-to-use condition, it will have a considerably greater number of gallons per hundred weight than white lead mixed.

Many difficulties have arisen from discoloration of leadless paints, and many hard words have been said about them in consequence. This discoloration takes place with inferior makes of lithopone, or it may be

due to the use of improper driers, or boiled oil containing lead driers. The finest grade when mixed with correct ingredients does not discolor, but keeps a beautiful white.

In this case the fault is undoubtedly due to the linseed oil with which the pigment has been ground. The remedy is to grind the color with the oil just before it is employed, and to use only oil of the first pressing, and which is as pale as can be obtained.

Some of Its Demerits

It does not combine with the linseed oil in the same way as lead to form a tough paint film, and has a tendency to disintegrate more rapidly owing to its absorption of moisture more readily than lead. This defect makes it less protective in character for outside painting, and something must be done to repair, as far as possible, this weakness.

In pursuing my investigations into this subject, the question naturally arose as to what was necessary to strengthen leadless paint so as to make it compare more favorably with lead for outside use. Something seemed to be needed to act as a binder so as to toughen the paint film to a greater degree than linseed oil.

Tests have proved that a good strong high-grade pale varnish will materially help to effect this desirable result. There is little doubt that only with the addition of varnish will leadless white give satisfactory results outside.

Exposed outside as an oil paint, it is liable to chalk and disintegrate.

It must not be combined with lead; being a sulphide, the compound is liable to blacken.

There is one way in which lithopone can lose its whiteness, and that is by the addition of white lead,

litharge or lead colors. White lead is acted upon by lithopone so as to sulphate it and blacken the lead, so that it is important that for white paints you should keep them separate. If they should get together in old paint stock of darker tints there is no harm, as they do not act upon each other to cause peeling.

It may be that some of the tests have proved greater failure than others, owing to lack of knowledge of the best method of mixing leadless paint. Much more oil should be used in mixing, and there should be a larger percentage of driers than is used in the mixing of lead, and a somewhat fuller coat should be given.

A large proportion of these flat finishes are very difficult to break up, probably due to some presence of rosin compounds that combine with zinc oxide. Most of them are composed of lithopone in combination with other pigments, some containing whiting. We found very few of these could be applied with ease. Most of them had a comparatively light petroleum thinner and would not flow out as the manufacturer said they would. Some contained lead and were off color.

FLOOR PAINTING

EW FLOOR, KITCHEN.—Paint is best for a kitchen floor. Prime with white lead tinted to agree with finishing color. Add as thinners turpentine or benzol, and no more oil than is in the white lead, if wood is hard pine. For second and third coats, where light color is desired, use zinc white or lithopone, in oil, colored to suit, and with brown japan and varnish, as follows: Beat up a gallon of paste zinc or lithopone in oil to a stout paste, add half a gallon of good brown japan, beat up again to a paste, add a little turpentine and thin out to brushing consistency with a hard copal varnish, a varnish that dries hard in about twelve hours.

SHELLAC FINISH.—A quick finish for the kitchen floor may be made with two or three coats of shellac varnish, colored to suit. Use dry colors for coloring, using earth colors only.

NATURAL FINISH.—First-coat with orange shellac, follow with one or two coats of hard gum floor varnish.

PORCH FLOOR. HARD GLOSS.—Hard pine, prime with white lead thinned with benzol or turpentine, or part of each. Tint priming color to approximate that of the finish. Some use a thinning made of raw oil $\frac{3}{4}$ and turpentine or benzol $\frac{1}{4}$ part. The primer must be well rubbed into the wood and not be too stout. Use just enough driers to make priming dry in reasonable time, and avoid use of too much. Second coat same

as first, only it should be thinned with equal parts of oil and turpentine, and driers. This will make an elastic and hard surface for next coats. The finish coat may be made from white lead, zinc, and silica, ground in oil, tinted as desired, and thinned out with a hard gum varnish to a brushing consistency.

Old Floors. Porch.—Touch up worn places with the paint advised for second coat on new floors. When dry, apply a finishing coat same as finish for new floors, either on worn and re-coated steps or all over porch floor, as condition may indicate.

Painting New Porch Floor.—The flooring should be painted on the under side before being placed in position, applying a coat of brown oxide or scrap paint thinned and strained. The joints or edges of the narrow boards should be leaded with white lead paste in oil before being placed. As most of the deterioration of a porch floor paint comes from dampness under the floor the wisdom of painting the under part is apparent. And the leading of the joints keep water out and makes a solid surface. These things are important and mean prolonged life to the floor. Two coats of paint on the under side would not be too much, and a coat on the edges, supplementing the leading, will be good.

Dust Color For Porch Floor.—The following pigments are to be made dry: Zinc white 25 lbs., white lead 5 lbs., bolted gilders' whiting 10 lbs., French yellow ochre 1½ lbs., lampblack ¼ lb. Mix all together, and add raw oil to form a stiff paste; thin with turpentine 5½ qts., copal hard-drying varnish 4 gals., and driers 6½ qts. Lithtrge is

better than liquid driers for floor paint. Ochre and fine silica both add to the wearing quality of a floor paint. Varnish hardens and toughens the paint. Never use boiled oil in floor paint. Portland cement and also plaster of Paris are used in some floor paint formulas. Little white lead is used, ochre is better, also zinc white. Some lead, but more zinc, is good.

Floor Paint Formula, Buff Color.—American yellow ochre 35 lbs., whiting 5 lbs. barytes 5 lbs., Portland cement 9½ lbs. All dry. Thin to paste with raw oil. Thin to working consistency with turpentine and varnish, more varnish than turpentine.

Hard Pine Porch Floor, Natural Finish.—Prime with three parts raw oil and one part turpentine, and *quantum sufficit* of driers. When hard-dry apply a coat of best spar varnish, and after not less than three days of fine weather; more time if weather is not best drying; apply a finish coat of the spat varnish.

Maple Flooring.—It is an error to prime this wood with oil, as some do, for it will darken it in time and spoil its delicate beauty. Prime it with white shellac, and finish with white copal varnish. Or two or three coats of shellac will make a desirable finish in some cases. The shellac surface should then be rubbed with a floor oil composed of 9 parts raw linseed oil and one part driers, well rubbed in. As the floor becomes worn it should be rubbed at least once a month with a reviver made from raw oil 8 pints, turpentine 1 quart, and white shellac one pint. Use a brush in applying this, and rub it in with a weighted brush around which wrap a cloth. The floor should

dry hard over night. Paraffin oil of light color and gravity also will freshen up such a floor and lengthen its life.

Hard maple floors may also be shellaced or shellaced, varnished and waxed, if a wax finish is desired.

The putty for nail hole or other defect in porch floor should be a hard and tough one, made as directed under the head of "putty," which see.

While cement has been given as an ingredient in a floor paint formula, yet we do not favor it on account of its caustic quality, which would cause it to attack the oil and form a sort of soap. Silex or silica and barytes both are much better than cement. Also, ochre and Venetian red may be used when those colors are not undesirable, in connection with some lead and zinc, etc.

Durable Floor Paint.—The following formula gives a paint that will dry well and prove durable, it being largely used in Germany: Mix up some white lead in boiled oil to a paste or stiff batter, and tint as desired. Get some old paint skins and burn them and gather up the ashes, which add to the paint, their purpose being to harden the paint. First grind these ashes in a mill, in turpentine. Add sugar of lead and turpentine for driers, and thin with pure boiled linseed oil. For body or base, zinc white is preferred to white lead, which is too soft. Use this paint for all the coats, only using a little more turpentine for the under coats, and it may be topped off with a coat of varnish if desired.—*Karl Holm, Van Wert, Ohio.*

Quick Painting of Floor.—If you have a floor that must be painted and yet not be out of use for more than a very few hours, try this: Color some shellac

varnish with whatever pigment you may desire, then thin down the mass with alcohol; apply two coats, allowing an hour between coats. If done in the evening the floor will be stone-hard and dry by morning. In fact, it will be fit to use in about three hours after it is done.

Finishing Hard Pine Floor.—Linseed oil darkens yellow or hard pine. Better shellac it, two coats, following with wax, which polish by rubbing. Or two coats of wax on the bare wood will do, rubbing to a polish.

Cleaning Greasy Floor.—A practical method for removing oil and grease from any floor is the use of a hot, saturated solution of common washing soda. This is prepared by dissolving as much of the soda as possible in a quantity of hot water. The solution can be made up in quantity and stored in a barrel or elsewhere. When about to clean the floor, the solution should be heated to near its boiling point and applied hot, supplementing its unaided action by a vigorous sweeping with a stiff broom or brush.

Removing Fresh Paint From Floor.—To remove fresh paint from the floor, cover with vinegar at once and wipe off with a soft cloth.

Removing Wax and Shellac From Floors.—Use benzine and a scrubbing brush, vigorously manipulated, for removing the wax. Use varnish remover, or amyl acetate, acetone, wood alcohol, or fusel oil or mixture, for removing the shellac. An awful smell results, and demands plenty of ventilation in the room. The scraper is a good thing for removing wax or shel-

lac; slow but sure, and no vile smells. Wax softens up easily under benzine, gasoline, benzol, and turpentine. The coating is usually quite thin and therefore not difficult to remove.

STICKY PAINTED FLOOR.—A painted floor would become sticky in humid weather; what could be done to remedy the evil? Remove the paint with paint remover. Do not try painting over it, as the trouble would not be helped any. If removing the paint is not feasible, try wetting it with water to which a little ammonia has been added, and clean up the floor. When dry, give it a coat of thin grain alcohol shellac, and in a day or so apply another coat of the shellac. Let it go at that or paint over the shellac.

A SUBSTITUTION THAT IS ALL RIGHT.—"A master painter tells us that one of his men, doing a porch floor, ran out of oil, and needing a little to thin up the paint, used an exterior varnish instead when he found no oil. The result pleased the boss, though his man had not consulted him about thinning with varnish, and he says it is one of the best wearing floors he ever had, retaining a good gloss." Which only shows that the boss did not know that varnish is a main ingredient for floor paints.

FINISHING HARDWOOD FLOORS.—For a thorough exposition of this branch of floor work we must refer the reader to *The Expert Wood Finisher,* which gives 25 pages on the subject, and contains all that is known about hardwood floor finishing and correlated matters.

PERTAINING TO INTERIOR WALLS

DAMP WALLS.—Permanently damp walls cannot be successfully treated by any kind of application on the interior side of the wall. The cause of the dampness must be ascertained and remedied. If it is caused by the admission of rain water into the wall through some defect in the building such defect must be corrected. Dampness from the ground may be absorbed by the wall, and when such is the case the water must be conducted from the building through a proper draining system. Porous brick walls, or very coarse cement walls, will often, on rainy days, absorb enough water to make the walls damp for a long time. Such walls should be painted on the outside with oil paint. As a substitute for oil paint (some painters claim it is better) a mixture of linseed oil, tallow and rosin in equal proportions may be used. Apply the mixture hot when the wall is dry.

Another treatment for exterior walls of this kind is made by melting in boiling water enough soap to make a jelly; this jelly is rubbed well into the wall and when this is dry a coat of alum solution in solution is applied. This should be strong, a pound of alum to the gallon of water; apply liberally. The soap jelly will not dry hard, but in dry weather the water will evaporate enough in twenty-four hours to allow of the application of the alum water.

The most satisfactory coating for damp interior walls, to prepare them for paint, is what is called Sylvester's Solution.

This process consists in using two washes or solutions for covering the surface of the wall, one composed of castile soap and water and one of alum and water. The proportions are ¾ pound of soap to 1 gallon of water, and ½ pound of alum to four gallons of water, both substances to be quite dissolved in water before being used. The walls should be quite clean and dry, and the temperature of the air not over 50 deg., F., when the compositions are applied. The first, or soap wash, should be laid on when boiling hot with a flat brush, taking care not to form a froth on the work. This wash should remain twenty-four hours, so as to be dry and hard before the second, or alum wash, is applied, which should be done in the same manner as the first. The temperature of this wash when applied may be from 60 deg. to 70 deg., F., and this also should remain twenty-four hours before a second coat of soap wash is put on. These coats are to be applied alternately until the walls are made impervious to water.

The secret of the working of such a process is that the two solutions of soap and alum, alternately applied, sink into the texture of the wall and form an insoluble sebate, this filling the plaster, and, being insoluble in water, it forms a waterproof coating. Water cannot penetrate or pass it from either the back or front, so that it makes a safe foundation for paper or paint.

If the dampness does not come from the outside, you can make a damp-proofing liquid by placing in a suitable vessel ten pounds of air slaked lime, two pounds glucose (grape sugar), one-half pound powdered alum, one-half gallon boiled linseed oil and one pint oil of eucalyptus, adding two gallons hot water gradually, while stirring, until all is dissolved. If this liquid on

cooling is too stout to work freely under the brush, add more warm water. You can mix with this liquid any lime-proof pigment, such as zinc or lithopone, Venetian red, ochre, umber or lime blue, using the mixture in place of paint.

Never use shellac varnish on damp walls, but you might try in place of the liquid referred to plaster of Paris wet up with weak glue size and alum solution.

Or, dissolve one pound of powdered alum in half a gallon of warm turps and apply to walls.

Next, three pounds of litharge in one gallon hot linseed oil. Go over walls with this after turps and alum are set. Put it on as near boiling as you can. Leave it stand from 8 to 12 hours.

Dampness will not penetrate this priming.

Size For New Walls.—Water glass is perfectly safe to use on new plastered walls as a size, because it forms in contact with caustic lime an insoluble silicate of lime, which is inactive because insoluble. The silicate of soda of commerce, when to be used for this purpose, is best diluted with double the quantity of water and applied with a fiber brush. When the plaster is very smooth and of hard finish, the water glass may be still further diluted with water and yet stop the suction in the wall. It will serve as a sizing for either oil paint or water paint.

Whether there is any chemical action or reaction, strictly speaking, when soap, glue and alum are mixed together we are not prepared to say, but it is a matter of fact that a mixture of soap and glue alone will not harden sufficiently to be painted over. The addition of alum hardens the soap to a certain extent and renders the glue insoluble on exposure to the air. When glue size without soap is used the addition of alum

keeps it from souring or molding, and when a size of soap without glue is used under water paint it is liable to rub up on the application of the paint unless alum has been added to the soap solution. The addition of alum to size also permits water paints to flow more freely and evenly over it.

About half a pint of strong vinegar to four gallons of water makes a good wash for killing the free lime in newly plastered walls. Give the wall plenty of chance to dry after using.

For the better class of work we have found that size made up of one-third gallon of benzine, one-third gallon of furniture varnish, one-third gallon of dry pigment, lead or whiting, brings the best results. You will use one-third less paint by using this formula for undercoating.

Filling Cracks In Plaster Walls.—"I have a painted wall to repaint, and there are some large cracks in the plaster; how shall I fill the cracks so that they won't show in the finish?" If you use plaster of Paris add weak glue size; the trouble with this filler is that it will shrink more or less, and so we use a hard glazing putty, mixing lead and whiting, dry, with a little varnish and oil to the proper consistency, adding also a trifle of japan; when this filler becomes dry enough, sandpaper it down smooth to a level with the general wall surface; paint the filler then to match the walls, and if one coat fails to make it as good as the old surface, apply more paint. Then sandpaper off and coat the entire wall surface.

Cracked Walls.—On ceilings and walls that are badly cracked up, and where large patches of new plaster have been added here and there, it is a sure case of

cracking again where the old plaster comes together; here I always use, if the walls are to be finished in oil paint, a heavy unbleached sheeting. First, of course, scrape and flush up all cracks and bad plaster, and paint the whole surface one coat; then apply the muslin with a heavy oil paint made of remnants and scrapings left over from different kinds of work, dark colors as well as light colors, stirred up and strained, to which add a portion of mineral white to a consistency of fairly heavy paste. Sheeting put up with this and afterwards troweled over with a plaster's trowel with a composition of similar stuff, painted with two thin coats and two heavy coats of paint, the last two heavy coats stippled, has proved to be a very durable and permanent surface.—*Correspondence.*

Tacky Paint.—Lime will not cure badly-smoked or tacky surfaces. These sometimes refuse to dry in spite of washing and rubbing. In this case working up a new paint, which has refused to dry, with driers, generally cures the trouble. Non-drying painted or varnished surfaces may also be treated in the same manner with a mixture of gold size and turpentine.

Trouble With Painted Walls.—"I have trouble with a painted wall, the painting being on plaster; the paint is eaten through in spots and some sort of liquid forms, looking like tobacco juice, which runs down the walls, this liquid and the paint running down together. What is the cause of this, and what can be done to the walls to stop it?" The trouble probably comes from an excess of alkali in the plaster. Most plaster walls would be better for a little acid size, not enough to injure the plaster, just enough to neutralize the lime. Vinegar is good. One of the best correctives

is sulphate of zinc, a pound to the pint of water, using soft water. Let this have 48 hours for drying. It may be well also to apply a second coat of this. But after the paint is on and trouble has set in, the only thing to do is to scrape away all the stuff and shellac the walls. Or wash off with benzine after scraping. then give it the shellac.

Flat Wall Paint Streaky.—When the flat wall paint dries out in streaks, or "flashes," it is because the paint contains too much oil. When strong tints are used it is necessary to use considerable tinting colors containing oil.

Before painting a room wall, dust off the tops of doors and windows, or you will get a fine mess of dirt into your paint. Housewives rarely clean off places not seen. Your wife does, of course; so does mine.

Cracked Walls.—Larger cracks may be repaired by cutting them out so as to form a key; that is, by making the inside of the crack larger or wider than the outside, so that when the plaster is applied, it will fill the inside space and be held there. To do this use a small trowel. Fill the crack quite full. A very large crack or break should be only partially filled at first, allowing the filling to become nearly or quite dry, then adding enough to fill up level full. If too much plaster be applied at once, in a large opening, it is apt to fall out by reason of its weight. A sand-finished wall crack may be repaired with a mixture of plaster and sand, equal parts, and some lime putty or thick slaked lime. Fill the opening with this, and rub it over with a float or block, to give it a rough appearance, like the rest of the wall. Some use Brussels carpet over a block

and some use it over a trowel. Wet the part now and then as you rub it with the float, and if you do the job right it will be hard to tell just where the repair was made.

A good mixture of putty for filling cracks in a wall may be made of plaster of Paris, four parts, and one part of whiting, adding glue size to form into a putty. First wet the crack. This putty will not set too soon, yet will in time become hard enough. It is best to dry the plaster before using, as it will give a stronger cement if dry. Place it in an oven, or in a pan on the stove.

Very small cracks may be filled by first applying a coat of glue size, to stop suction, and when dry rub in some of the plaster putty.

Where breaks occur, or large cracks, whereby the edges of same are above the rest of the surface, it will be necessary to remove the projecting parts and fill in with plaster. The proper preparation of the wall surface is just as important and worthy of care as the calcimining, and unless it is done you will not get a nice job.

In using lime with the plaster be careful to not get too much in, its object being to retard the setting of the plaster of Paris. After the plaster is dry, shellac it. Never sandpaper the plastered crack, but trowel it down smooth and hard. To fill up sunken parts, use a mixture of whiting and glue size, thickened to a putty with plaster of Paris, to which add a little varnish. This should be left to harden and dry. It will become very hard, and can be spread out quite thin.

Plaster of Paris mixed in vinegar containing some table salt will give a good filler for cracks, and it does not set too quickly, while the salt makes it very hard when dry.

When mixing plaster filling do not pour the water on to the plaster, but scatter the plaster into the water as you stir the mass.

Stippling Painted Walls

Assuming that the walls are in ordinary condition, or that there are a few imperfections, such as small cracks, etc., these should first be repaired with plaster of Paris, and when dry these parts should be sand-papered smooth and then brushed down, thus getting a smooth and clean surface to paint on.

The first coat of paint should be full and round, oil paint, made to dry with a gloss. It should be tinted or colored to match the finish. Allowing this coat of paint to dry hard, we would then apply a coat of glue size, made by melting a pound of best white glue or gelatin in a gallon of water. This size must be applied while hot. When the glue has become perfectly dry apply the stippling coat of paint.

First, however, make up your thinners for the paint, mixing together a gallon each of raw linseed oil and turpentine, which must be well shaken up. The paint is made from white lead, though some workmen prefer a combination base, made of lead, zinc and barytes or silica, saying that it gives a clearer paint, producing sharper and clearer tints.

Thin up your base, whether all lead or a combination base, with the thinners specified, making the paint about like buttermilk in consistency, or perhaps rather thicker, more like cream. In another vessel place some best grade of plaster of Paris and mix with it some of the stock thinners, making a mixture of the same consistency as the paint.

Mix together equal quantities of the paint and plaster mixture and stir until the mass is perfectly amalgamated. Then tint the mixture whatever shade you desire for the finish.

It is well to apply this stipple coat as heavy as one can well spread it with the brush; stipple it at once. Bear in mind that the stippling must follow the application of the paint closely. On large surfaces it will be necessary to have been enough to paint and stipple entirely across the wall at one operation, thus finishing the wall while the paint is fresh. In this way there will be no danger of laps showing. This is very important to remember. A single lap would destroy the beauty of the whole job.

Another important matter is to have the proper scaffolding, so that there will be no delay at any time owing to inability to get along with the work.

The use of a thinner composed of oil and turpentine, half and half, will give a stippling that will dry with an egg-shell gloss. If you desire a dead flat effect, then make a mixture of turpentine two parts and oil one part. Bear in mind, however, that the more turpentine you add the quicker the paint will set. Therefore, the dead flat finish will demand livelier work, with no time for talking or fooling.

A stippling done as indicated in the foregoing instructions will result in a finish like unto pebble goat leather, and after it has become thoroughly dry it will be hard as stone.

Painting Office Walls

"As a rule, three coats of paint are sufficient to properly cover a wall. Often times the wall is in such condition that four coats are necessary to make a good job.

"In mixing the paint for the first coat as much boiled linseed oil should be used as the wall will permit; then the second coat should contain a less quantity of oil. After these two coats have thoroughly dried, a coat of glue size should be put on in order to give a smooth and hard surface on which to apply the last coat. In mixing the material for this coat, the painter should use about one-quarter to one-third as much zinc as he does lead. This makes a hard surface. Immediately after the last coat of paint is put on, it should be stippled, that is, the walls should be patted with a stiff brush, and this must be done before the paint dries; therefore, if a room is fairly large, this is only accomplished successfully by having two men work at the same time—one doing the painting and the other following immediately after with his stippling brush.

The stippling of a wall obliterates the marks of the paint brush and makes a uniform surface. Painted walls treated in this manner look extremely well. Three-coat paint work costs about 21 to 22 cents per square yard, whether done by contract or by the day." —*G. Folsom.*

PAINTING NEW WOOD WORK, EXTERIOR

RIMING COAT.—So many different kinds of wood are now used in building that painting is no longer the simple process it was when white pine formed the sole material for that purpose. It is easy enough to prime and paint white pine, which contains nothing harmful to paint, excepting rosin, as seen in knots and streaks, and which was of infrequent occurrence on even second-grade timber. It will be necessary, therefore, to take up each wood by itself and explain how it must be treated to make a successful job of painting with it. Beginning with white pine, the priming coat may consist of white lead thinned with raw linseed oil and a very little japan driers, or with 80 or 90 per cent. oil and 20 or 10 per cent. turpentine, as preferred. The old way was to use only the oil, but modern painters add a percentage of turpentine, saying it makes a better penetration than oil alone. In former days, too, the percentage of lead used in priming was larger than now, and some painters now advocate all oil, with a little turpentine, while others prefer just enough lead to whiten the thinners. The best practice, however, would be to allow liberally of lead, making the paint thin enough to flow easily, and then to rub into the wood all the lead and oil it will take up, leaving practically nothing on the surface.

PRIMING CYPRESS.—As a prominent painter puts it, cypress is of a peculiar nature; it is full of a greasy substance, so that when you give a rub or two over it

with sandpaper you find the paper clogged with a gummy stuff. Something must be added to the primer to cut this greasy substance, and it is recommended to use a mixture of 80 per cent. turpentine and 20 per cent. raw linseed oil. This amount of oil acts simply as a binder for the turpentine paint. The turpentine carries the pigment particles into the wood, and this holds the priming to the surface, after the turpentine has evaporated.

Some advocate the use of benzol in place of turpentine for priming cypress. It is not necessary for white pine, nor as desirable as turpentine. Use the benzol in same proportions as turpentine is used.

A Texas painter, P. F. H., says he has tried about every way that it can be tried, and he finds that in mixing priming lead for a two-coat job it is best to add from 5 to 7 gallons of oil to the 100 pounds of lead. The idea is that when only two coats are to be given the priming will have to be heavier than for a three-coat job, and of course it would, but no good job can be done with two coats on new wood. This painter also thins with from 4 to $4\frac{1}{2}$ gallons for the second coat.

Breaking Up White Lead.—The usual method is to take out some lead, placing it in a paint pot, if for a small amount, or in a large vessel if a large quantity is required. So far well and good, but the frequent mistake made is to pour entirely too much oil in at the start. The best way to do is to begin with the keg of lead. Say it is a 100 pound keg. Take a stout paddle and run it down the sides of the lead, next the wood or metal, and gently push the lead toward the center of the mass, going around the entire circumference in this manner, two or three times, and then

work it from the middle toward the outer edge, doing this a few times. In this way the lead will soon be made into a smooth, soft mass, in which condition it will be much easier to mix, saving time and labor. Now, some of the lead may be put into a paint pot, if for a small job, and mixed as desired, but allowing it to stand for some hours, a day not being too long, for after standing some time the paint becomes finer and tougher and makes a better job.

Start mixing lead by adding a very small quantity of oil to it, not more than one pint to 100 pounds of lead. With a good, strong paddle work the oil completely into the lead, then add another pint of oil, working this also into the mass. Then a quart of oil may be added at a time, working each installment of oil well into the mass until you have worked in about a gallon and one-half into the 100 pounds of lead. For smaller quantities of lead smaller quantities of oil may of course be employed.

The mass will now readily thin down into a perfectly smooth paint, entirely free from lumps, though there will be some skin or other similar matter present, and hence the mass must be passed through a fine wire strainer before using. If any color is to be added, then add it before the final thinning, or while the lead is in a paste form, which will allow of the color being mixed into the mass more readily and perfectly. Some pigments, lampblack being the worst, are difficult of admixture with oil paint, and ought to be mixed with the paste or else be thinned when to be added to mixed paint. I have seen an old and expert painter try to mix oil-ground lampblack in thinned paint, and he simply could not do it, for the black would float on top.

Driers also should be added before the final thinning. Also it is best to not add driers until ready to use the paint.

The following method of painting was given us by a venerable painter, Mr. F. A. Carr, Sr., of near Pittsburgh, Pa., several years ago. He said it never had been given publicity before. For the priming of exterior work, add a pint of turpentine to one gallon of raw linseed oil, and mix with not more than six pounds of white lead, not more than four, and an ounce of litharge, powdered. Mix, strain, and rub well into the wood, rubbing across the grain. For second coat thin white lead with equal parts of oil and turpentine, omitting driers. Make a paint that will weigh 16 pounds to the gallon, if temperature be below 60 degrees, and 18 pounds if above that degree. Allow priming coat to stand for one or even two weeks, and same with the second coat. The third and finishing coat is made from white lead thinned with oil that you have prepared thus: Add one pound of litharge to a gallon of raw oil and let it boil 35 minutes, then let it stand over night. Then pour off, leaving sediment at bottom. This will make the best drying oil known. Mix the paint so thin that it will readily run from the paddle. There should also be added to the oil in boiling some beeswax, or it may be dissolved by itself, which is perhaps the better way, in a little oil. To each gallon of mixed paint use $\frac{1}{4}$ ounce of beeswax. This paint dries with a good gloss, and under cover it will remain glossy five or six years. The small portion of wax is sufficient to keep the paint from running and chalking. This method requires more time and trouble than the common way, but where a strictly first-class job of exterior painting is desired it has all to commend it.

Coloring may, of course, be added. The method takes somewhat less white lead than usual. The aged painter says that if you wish a white job that will retain its freshness for years, try this. He adds that the complaints against white lead chalking, etc., are to be laid at the doors of the painters. He believes that the addition of a very little fat oil adds to the life and beauty of the finish.

Painting White Pine.—This is a soft, close-grain wood, now a very scarce variety, but still without an equal for house building. The best description of this wood and its treatment with paint appeared in a pamphlet some time ago, from the pens of A. M. Heath and J. B. Campbell, practical paint men, and who had made tests of the various woods used in house construction and elaborate experiments with their painting. This work was entitled, "Practical House Painting." I take the liberty of extracting this account of white pine painting, sure that it will please my readers and not offend the authors named:

"It seasons well and is comparatively free from shrinkage; it has good absorbing qualities and readily takes paint on account of its even, uniform grain. For priming the reduction should be a medium thin consistency, carrying enough turpentine to assist in penetration and working. The priming should be applied with a full brush and be well and evenly brushed out. Ample time must be given for thorough hardening. While paint dries well on this surface, the lumber runs to occasional pitch pockets, into which paint penetrates very slowly. Over the sap and pitch pockets the paint dries very poorly, and unless ample time is given for thorough drying over these places the paint will break loose in a comparatively short time after the priming

coat has been applied. These pitch pockets are easily detected by the coat spotting. Don't paint over such places until they become thoroughly dry.

"Owing to the even, uniform grain and color in white pine satisfactory two-coat work can be done on this lumber."

The usual, I believe, proper method in priming white pine is as follows: In the priming coat the vehicle should be proportioned 80 per cent. linseed oil and 20 per cent. turpentine, the paint light in body; second coat the same in vehicle, but the paint considerably heavier bodied; third coat, 90 per cent. linseed oil and 10 per cent. turpentine, some recommending all oil in this coat. In my practice I found that the 10 per cent. turpentine enabled me to more fully control the proper application of this paint and it would dry harder by the use of the turpentine. Frequently in the eastern states we are called upon to give new woodwork four coats, that is, the priming coat and three additional coats. In that case my third coat would consist of 85 per cent. linseed oil, 15 per cent. turpentine; and the fourth or final coat would contain 10 per cent. turpentine.

PAINTING BASSWOOD.—Known in some localities as linn, or linden. It is becoming more generally used for exterior building.

Basswood is straight, close-grained, and of compact structure. It is light, soft and tough, but not durable. It is not difficult to season.

Being a soft, close-grained wood, of medium absorbing qualities, it takes paint readily.

Owing to its compact structure, the primer should be mixed thin and elastic, so as not to set up too quickly, and to allow time for the wood to be fully satisfied.

The priming coat should be applied with a full brush, and should be well and evenly brushed out.

Paint dries extra well on basswood lumber.

Owing to the color, as well as the grain of the wood, satisfactory two-coat work can be done over this lumber.

Painting Redwood.—This wood grows only in the State of California, and there in very restricted parts. It comes from the famous big trees, though of these there are two species, *Sequoia Gigantica*, or big tree, and *Semper Virens*, or ever living tree. It is from the latter trees that we get our redwood, as the wood from the former is valueless for building purposes. It is a durable wood, but seems to contain an acid, which acts upon paint and causes trouble. It is said, by its admirers, that when properly painted this wood will show less change after years of wear than almost any other wood. Being free from pitch, it does not easily take fire. It has a hard, non-absorbent figure or heart growth, with a soft body outside of that, hence the priming coats needs some benzole or turpentine with the oil to enable the primer to enter the harder parts. A good mixture would be 70 per cent. raw linseed oil, and 30 per cent. turpentine, adding one-half pint of benzole to the gallon of the mixed priming paint, reducing the amount of turpentine that much. Do not add the benzol until ready to use the paint, as it is a quick evaporator. Make the primer light, and brush well into the wood.

An expert car painter says that a car made from redwood and painted in the usual manner of painting will blister and peel after a few hours' exposure to the sun. He now prepares the wood by priming it with a liquid made from raw linseed oil, with a pint of ben-

zine to the gallon of oil. Any of this remaining on the surface after about two hours is wiped off. It is allowed then five days to become dry, after which it is coated with this paint: To 15 pounds flat lead color add 15 pounds dry litharge, mixed as follows: Add enough best coach japan to make the litharge about like mush, then pour it into the flat lead. Stir the mass and run through a paint mill, make fine as possible, then thin to proper brushing consistency with turpentine, and apply three coats, one a day. This forms a hard and tough coating, proof against the acid of the redwood.

Painting Cypress Wood.—This is a southern tree, *Taxodium Distichum*. Its leaves being narrow it is classed among the soft woods. Locally known as Bald, Black, White, Red, and Deciduous Cypress. Not as abundant as the pines. In its uses and appearance it is not unlike white cedar. Of a very durable nature. Really a sub-tropical swamp wood, being found often with a height of 130 feet and diameter of 12 feet. Excellent wood for exterior finish, and with many merits recommending it for interior finish. Good color and free from sap. Straight grain, light and strong. Taking the place of white pine now. When exposed for a length of time on exterior and without protection, it gets dark and unsightly, but of course it is nearly always painted.

Prime this wood as soon as possible after it comes from the planer, for its grain soon rises under influence of dampness in atmosphere, then it will be rough. The priming coat should be made from white lead thinned with raw oil and turpentine and a little drier. The addition of a pint of turpentine or benzol to the gallon of primer will make a better job. Some use

only a coat of japan dryer, which makes a good surface on the wood. Others advise thinning lead with benzol only. If only oil is used with the primer the paint will dry in streaks, some dry and some not dry. After the primer apply two or three coats of white lead paint, a little turpentine in all but the last coat. Rub each coat out well. Interior cypress that is to be painted had better be primed with shellac varnish. Use grain alcohol shellac, white shellac preferred, and make it thin. Then rub down with fine sandpaper, after which apply the finishing coats.

Be careful about adding driers to the priming coat, as we do not wish the paint to dry too fast, as the paint should have plenty of time for entering the wood before drying on the surface. The paint for cypress should be rather stiff and be well brushed into the wood. The primer may be thinned with raw oil 20 per cent., and benzol or turpentine 80 per cent.

Painting Yellow or Hard Pine.—There is said to be 39 varieties of pine in the United States. The pine used in building is variously known as Hard, Yellow, Longleaf, Shortleaf, Southern, Norway, and Red Pine, according to the locality in which it grows. All are similar of structure as to their reception of paint, being a hard, heavy, tough, strong wood, coarse of grain, compact of structure, and very resinous. A very difficult wood to paint. In fact, it is not at all adapted for paint, and in former years was little used where paint was required.

Southern painters claim to have discovered that if a certain amount of pine tar is added to the priming coat of paint there will be no scaling of the paint. They use one part of pure pine tar to seven pars of pure raw

linseed oil. The paint is mixed quite thin, and is well rubbed into the wood. The priming is allowed a long time for drying, the longer the better, then it is followed by a coat of lead paint, made rather thin, tinting it slightly with lampblack, so that it will cover the wood better, if the finish is to be white or very light; this coat is well brushed out, and when sufficient time has elapsed the third coat is applied, this time being rather stiffish, and without color, if to be left white. White lead is used in the priming and all succeeding coats. Avoid heavy coats, for they will cause blistering on hard pine. Two coats of paint on a priming coat is usually enough to make a good finish. Use very little driers.

A painter in *Carter Times* tells about a hard pine job he did, sandpapering and shellacing it, and the paint would not adhere; so he removed paint and shellac down to the bare wood, and scraped and sandpapered the board again; then he primed with equal parts of white lead, in oil, and dry red lead, thinning with two parts raw oil and one part turpentine, forming a thin paint. He strained this, and rubbed it well into the wood. After this had become hard-dry he applied two coats of white lead paint, and he had no further trouble with the job. He thought the red lead did the business, and perhaps it did. Many southern painters put a little pine tar in the priming for hard pine siding, and say it is a sure thing.

First, where possible, the job ought to be allowed to stand to the weather for two or three weeks before painting. In this time the weather will dry out the wood, and season it, bleach out the pine sap, and open up the pores.

If the painting must be done at once, then the torch should be used, to dry out the sap, which may then be scraped away. Then prime with equal parts of red and white lead, thinning mostly with turpentine. Some say use red lead alone, but it is apt to form too hard a surface, and not hold paint well. One painter advises a coat of benzine to the bare wood before paint is applied. After applying the benzine let the work stand a week. He adds that such a method will ensure a durable job. On any other wood the benzine treatment would result in causing the paint to peel.

"Under all conditions, in priming hard pine, thinner mixtures and more turpentine must be used than would ordinarily be employed in priming a hard surface, the amount of turpentine varying, according to the run of lumber, from 25 to 40 per cent. of the total amount of thinners used. Do not be afraid to use turpentine freely with this lumber, as this vehicle restores the life or vitality which nature has given it.

Turpentine will assist in opening the pores of the wood and give greater depth of penetration, as well as carrying or driving the sap into the wood to a greater depth of binding on the hard or fat places.

Apply the priming coat with a full brush and brush out well and evenly. Do not allow the brush to slip over the hard places, but work the paint well in. Extra care must be taken in brushing over this surface in order to even up the priming and not have too much pigment on the hard parts.

If a building is allowed to stand for a short time before priming the grain of the wood will raise and allow of better penetration.

Paint dries very slowly on this lumber, and ample time must be allowed for thorough hardening and absorption.

Two-coat work can not be recommended, as thin coats are absolutely necessary to insure depth of penetration or binding.

Three thin coats, well brushed out, will not leave an excess of paint on the surface, while two coats, which would necessarily have to be heavy in order to hide or even this uneven surface, will break away or scale in a comparatively short time."—*From Practical Painting.*

"As I have before stated, I found quite a number of painters practicing and recommending the coating of Southern yellow pine all over with from one to two coats of shellac as a preventive of pitch coming to the surface of their paint. In theory this may sound good, but in actual practice it is bad, very bad, for in attempting to keep the pitch in the wood from interfering with the paint you have elected a substantial barricade to keep the paint out, and from coming into contact with the wood you have set up an impregnable film or barrier between the wood and the paint. This shellac film being subject to the attack of a natural enemy, dampness, found both within and without, as no exterior building lumber is perfectly dry when erected. In fact, the rule is the reverse and dampness cannot fail to attack it from without at some period of the operation, the result being shortly a breaking down of the shellac with ruinous results to the paint and woodwork. A discriminating use of shellac and dryer is recommended, and that each coat of paint be *thoroughly* dry before a subsequent one is applied. The practice of giving exterior new lumber but two coats of paint should be most strenuously condemned. In meeting lumber conditions it is a physical impossibility to give a satisfactory appearing job with two coats and meet conditions. It positively will not give

the necessary protection for the wood. It should have at least three coats."—*Ibid.*

For Oregon and Idaho pine and similar woods I would increase the percentage of oil to 55 per cent. for the priming coat, the turpentine reduced in proportion, but still adhering to the proportion of benzole.

More trouble is brought about through the attempt to hide or cover this surface with heavy oil coatings than from any other cause.

The absorption is very uneven, varying from quite rapid on the clear soft parts to very slow on the hard or fat parts.

Where Georgia pine wainscoting is to go against a rather cold or damp wall, give it two coats of lead and oil paint; a little turpentine will tend to make the paint harder, and a proportion of red lead might be an improvement, causing the paint to dry better and make it hard.

A lumber dealer in the hard pine district has given considerable attention to the matter of painting on hard pine, and comes to the conclusion that to make a durable job the wood must have oil, and the wood must have such treatment as will enable it to take oil. First, he primes the bare wood with turpentine. This causes the wood to become absorbtive of paint. Then he mixes up "some good pigment," which he does not describe, with pure raw linseed oil to form a stiff batter. This he then reduces to a proper consistency with turpentine, this forming the first or priming coat. The oil in the mixture prevents too rapid evaporation of the turpentine, while the latter opens the pores of the wood and allows the paint to enter. In ten days the next coat of paint may be given, using pure raw linseed oil and any desired pigment. He says a barn painted

in this manner has stood for three years, shows no signs of scaling, and is in first-class condition. But battens on the barn, of Norway pine, were not treated with the turpentine priming, and the paint is scaling from them.

As a rule, the heartwood of trees is more receptive to paint than the sapwood, a notable exception being yellow pine, the sapwood of which costs less than the heart and takes paint better; therefore, if protected by paint, it will last longer in frame buildings. The rail road people who are progressive have found this out, and are rapidly substituting sapwood for heart-wood in freight-car construction. We are surprised to learn that many reputable architects in the Southern States still specify the heartwood of yellow pine for siding upon houses of the best class.

Painting on Elm.—A tough, fibrous, durable, strong, hard, heavy and often cross-grained wood. While used extensively for heavy timber and structural work, it is not used to any great extent for exterior building. Heartwood, light brown; sapwood, yellowish white. Seasons moderately slow and takes paint readily on account of its fibrous nature. For priming, the reduction should be to a medium thin consistency, carrying sufficient turpentine to assist in penetration and working. The priming coat should be applied with a full brush and be well and evenly brushed out. The paint dries well on this lumber, but ample time must be given for thorough hardening. Satisfactory two-coat work can be done over this surface if judgment is used in reducing the priming coat and the surface fully satisfied and evened up..

Removing Old Paint From Weatherboards.—If the paint which is to be gone over is sticky, cracked

or blistered, it must be removed clean to the wood, if you want good results. If there is but one to four coats on the object which is to be painted, and it is sticky, it can be washed thoroughly with a solution of two pounds of sal soda to a gallon of warm water. Use an old paint brush and lots of elbow grease to apply the soda water. This takes off all dirt and grease and hardens the old paint. Leave the soda water on at least an hour, so it has a chance to eat in, and harden the coats below. After it has stood an hour or more rinse it thoroughly with clean water, sandpaper and give it a good coat of cider vinegar. Coat the work with lead thinned three-quarters turpentine and one-quarter oil. Over this apply your paint as you would over any priming. I have had very good results in treating my work in the above manner.

If there are more than four coats of old paint on, it must come off to the wood. Some claim they can use paint remover. This, however, is very expensive. A solution of lye or potash is much cheaper, but this makes too much muss. To rinse it off you must use lots of water, which floods the lawn, walks, etc.

Painting Poplar Wood.—This, I think, is the very best substitute for white pine. I have painted the exterior of house finished in poplar, and the condition of the old paint was very satisfactory. It is a soft wood, stiff, clear, fine and straight of grain. Seasons well and shrinks very little. An intelligent carpenter informs me that poplar is apt to warp, hence it is not so desirable as white pine, but this may involve only a variety of poplar, either the white or yellow. As far as I can tell, it has most of the characteristics of white pine in its behavior toward paint. The priming should be the same as for white pine, and be

applied the same. Paint dries well on this wood, and if of a good surface as to streaks or color, two-coat work can be done satisfactorily over it.

PAINTING COTTONWOOD.—While this wood resembles poplar in many of its features, yet it is less desirable, owing to the difficulty of seasoning it and its liability to warp, besides which it absorbs moisture readily, and exposure to the weather for any considerable length of time will result in its decay and darkening; it must be protected fully by paint. Being also subject to dry rot if any moisture is in it when paint is applied, the rot will proceed beneath the paint. The priming coat should contain plenty of oil and be allowed a long time for drying, so that the wood may become saturated with the oil, which will tend to preserve the wood from decay. Two-coat work cannot be done with satisfaction on this wood. All in all, it would seem to be very good wood for structural purposes, at least as regards its painting.

PAINTING ON SPRUCE.—A house covered with spruce clapboards should not be painted until it has stood thirty days or more. If cracking or shrinking of the wood is to occur, it should be found out at this stage, and putty would remedy the trouble.

If a rain storm should thoroughly soak the wood, it would cause little or no harm. On the contrary, it would open up the pores of the wood that had been calendered or rolled down by the machine that cut and smoothed the clapboards, and afford a better foundation for the paint than the smooth hard clapboard.

A little more turpentine may be added for priming coats on spruce wood, as it is quite hard by nature. Five per cent. of benzol might be added for penetration.

It often occurs that the owner or builder of a new house insists on having spruce clapboards or weather-boards primed almost as soon as they are nailed on. In such cases cold water may be added to the priming color; about one pint to one-half gallon of paint. This water will not thoroughly mix with the paint, but will be distributed through it in small globules. The paint should be frequently stirred.

An old painter of my acquaintance frequently said that "the man who did not know how to use water in his paint did not know his business."

The addition of the water to the oil paint is to produce mechanical results, and is not intended in any way to cheapen the paint or to cheat the customer. Linseed oil paint, however well brushed, cannot be driven into the pores of hard spruce wood, especially if the wood is sappy. The addition of the water, when worked against the wood by the brush, opens the pores of the wood and gives the paint a firm lodgment. Moreover, sappy and wet clapboards painted in this manner will dry out flat, allowing a better foundation for succeeding coats, while pure oil paint will dry glossy on every clapboard where the fibre is hard or sap is pronounced. Such places will ultimately loosen and throw off all paint, as the pigment cannot attach itself to the fibre of the wood.—*Wm. E. Wall.*

Notes on Priming Woodwork

—Better prime the woodwork, interior, before the plasterer gets to work.

—Never use zinc priming on bare wood, for it will cause scaling of the subsequent coats of paint.

—It is bad practice to use odds and ends of paint for priming good work with, though it may do well enough on rough brick work.

—To prime redwood use white lead thinned with raw oil and at least ten per cent. of turpentine, or benzol.

—Use raw oil in priming, not boiled oil, and give the wood all it will absorb.

—There is nothing as good for interior and exterior priming as white lead that is pure and finely ground in oil.

—Red lead is the only pigment that may be used dry and mixed with oil, etc., for priming with; other pigments are too coarse without grinding; white lead need not be used in the dry state.

—For the best inside priming where first-class work is to be done thin white lead with raw oil two-thirds, and turpentine one-third.

—When priming clapboards be sure to do the under edges of the weather boards, and avoid fat edges and runs; wipe any off as they appear.

—For priming old work add a little red lead to the white lead, for it will stick better than white lead alone.

—Old exterior work having the paint well worn off may be primed with raw oil, no pigment, and when dry apply a thin coat of paint.

—Outside priming should consist mainly of raw oil, but should have enough lead to make a foundation for the finish.

—Boiled oil will dry in from 3 to 10 hours, and has a varnish-like body, hence is not fit for priming coats. The oil must penetrate well and fill the wood.

—Cypress is an oily or gummy wood, and will not take oil paint well, the paint not sinking in nor drying well. Some prime with shellac, others use raw oil one part and turpentine or benzole three parts.

—In damp weather the priming coat may have more driers than usual, but not too much. In cold weather

the same, with a little turpentine to assist penetration.

—A primer that is too stout will cause brush laps and cannot be brushed into the wood; the laps will show up under a dozen coats.

—The priming coat will be the better for being mixed the day before; strain before using; use very little pigment.

—Cheap ochre takes little oil, hence makes a hard and scaley surface. Best ochre takes much oil in grinding, hence is best for priming when you must use ochre. Better not use ochre of any kind for priming coats.

—White lead thinned with raw oil and no driers makes the best for all soft woods; in damp or cold weather add a little red lead, enough to give the lead a slightly pink cast. Or a little good driers will do.

—Some painters never use turpentine on priming coats, others never use any driers.

—Thin priming applied to hard wood will run; make it stiffer than for soft wood and brush it out well.

—Many painters tint the priming to approximate the finish coat, which may be darker or lighter as the finish coat may be. By tinting each coat of paint one can see better if any miss has been made, and the paint covers more solid in color by this arrangement.

—No ready-mixed or store paint is fit to prime with, nor indeed is it ever made for that purpose. Take this case for example, and one may see how impossible it would be to thin down such a paint for priming: White lead 56 parts; barytes, 28 parts; iron oxide 10 parts, white lead 6 parts. This paint was thinned with badly adulterated linseed oil and adulterated turpentine.

—Never apply the priming coat with a new brush, for it will not spread it evenly nor brush it into the wood; it will leave bare parts and ridges, and these

will show up in subsequent coats. Never use a flat wall brush for priming.

—Old surfaces, exterior woodwork, may with advantage be wetted before priming, as some painters practice it, using a calcimine or wall brush, the water causing the wood fibers to swell and close up, making a more solid surface for the paint. The priming then should contain much oil and ample driers.

—As an old and very absorbent surface sucks the oil out of the paint, leaving a more or less lifeless coating, it is best to size with glue size, then with the priming coat. Some advise two coats of strong size, and then the priming coat of oil paint. This would be better in our opinion than wetting the wood.

Painting New Wooden Buildings.—The consideration of the character and condition of the surface is the most important factor in the work. The kind of lumber used in the construction of the building should be carefully studied. Determine whether hard open-grain or hard close-grain; soft close-grain or soft open-grain; soft and spongy, compact or solid; also whether it is kiln- or air-dried lumber; if kiln-dried, and the drying process has been carried on too rapidly, the wood may have become case-hardened, leaving it brittle and lifeless. The lumber having thus lost part of its vitality or physical strength, the paint must be mixed to a consistency which will penetrate to a depth that will insure satisfactory results. If the paint is of a heavy consistency, and lies on the surface, the fibers of the wood will break away through contraction and expansion, bringing the paint with it. This trouble is always laid to the paint, while the real cause is that the priming coat was not properly reduced when applied, so it would penetrate to a sufficient depth to insure proper binding.

Wood that has been air-seasoned has had little or no opportunity to lose any of its strength or vitality, and it will hold paint well, if the priming is properly reduced and is thoroughly brushed into the grain.

It is impossible to have all of a building constructed from lumber from the same tree and from boards of the same physical strength. Part of the lumber may be kiln-dried and case-hardened; part may be air-dried; part of the logs may have been cut in winter, when sap was down, and part in summer, when the sap was up.

While it is not practicable to have separate mixes of paint for the various characters of lumber in the same building, it is practicable and necessary to examine the work to be painted and note its characteristics as to absorption and drying qualities; also the condition of the lumber—whether old, discolored, and partly decayed from lying in the log too long before being cut or in some damp place after it had been cut into lumber. Carefully consider whether two or three coats are necessary in order to produce satisfactory results.

It is impossible to do satisfactory two-coat work on certain kinds of lumber. A priming coat mixed heavy enough to assist in hiding the dark spots or grain will not contain sufficient oil or thinners to fully satisfy the wood, and the wood would soon rob the paint of its oil or binder. The priming coat being applied heavy will not allow sufficient penetration of the second coat to assist in supplying the wood with sufficient oil to hold the paint to the surface, thus resulting in the paint breaking loose in scales, elastic on the outside and lifeless on the side that was next to the wood.—*From Practical Painting.*

RE-PAINTING

SOME customers believe in one coat of paint every two years. They have followed this method for several years. One should never try to argue the matter with them, for if they are satisfied the painter certainly should be. But it is wrong, both in theory and practice. It would be much better did they repaint every four year instead and use two coats. No one can get a first-class job with one coat over paints which have been exposed for over two years. It will show brush marks, particularly close to the frames and corner strips, where there is no chance to brush them out. Other objections are, the old paint underneath absorbs the oil and the gloss soon fades. There must be a certain amount of oil in the last coat. If there is not, the pigment soon begins to chalk and wear off. Considering the time that paint should look well, two coats, applied two years apart, will look as well for as long a time as three coats applied every four years.

TRIM OR BODY FIRST?—It has often been noticed that in perhaps a majority of cases, painters when at work upon a house, paint the body, or at least a course of it, before they begin to put on the trimming color. It is proper to trim some parts of a house last, but on other parts it is more convenient to put on the trimming color before the body color is applied.

As a rule, in putting a coat of more than one color on a house at one operation, paint the cornice first, the body next, and lastly the corner strips and frames. This is a small matter and seems to be not worth

mentioning; still there are many who put on all the finishing coat before they do any trimming. Many allow the body coat to dry before trimming. In either case it requires moving and placing the ladders and scaffolds twice where once would do if they finished at once as they went.

When you strike the old frame house that has been neglected for years, it is important to take into consideration the conditions of the building. For instance, the south side will be far more porous than the north side, the upper part of the weather boarding under the cornice will be in better condition than the lower part next to the "water table," etc.

No outside painting should be second coated within 48 hours, and 96 hours is better. Raw oil is far the best for paint, with a little good japan drier added in cold weather. On the first coat add one-fifth turpentine to your lead and oil and see that paint is well paddled before using.

If spruce is primed with yellow ochre instead of white lead it will cause blisters to form in 20 years from the time the paint is applied, if repainted once or twice during the interval. Spruce clapboarding primed and painted with white lead will very rarely blister, and then only when moisture from below causes the paint to lift up from the wood.—*Wm. E. Wall.*

"Each coat should be put on before the previous coat is thoroughly hard. My reason for this is as follows: If your first coat is thoroughly hard the second coat will not penetrate but will only stick. If the under coat is not too hard the second coat will soften the first, let the oil and pigment penetrate through it.

to the wood, thereby cementing it thoroughly to the first coat. As soon as the oil is out of the pigment, it begins to chalk, there being nothing to hold it. My method of three-coat work makes it possible to get more oil in than can possibly be put in with two-coat work."—*Correspondence.*

To do a first-class dead flat job mix the zinc in turpentine and let it stand over night. Then draw off the liquid and mix again, drawing off the liquid as before, after it has stood some hours. In this way you can abstract the oil sufficiently to prevent it from influencing the job. The less oil the better in dead flat, as a trace of oil is sure to discolor the white in time.

For inside painting use the finest ground lead, and strain the paint. Pure or straight white lead alone should be used, and the addition of white zinc of good quality is recommended to give the paint whiteness where white paint is used. Where delicate tints are to be used we advise using zinc alone, as it gives the finest results in tinting. Zinc may also be used inside in place of white lead, if objection is made to the poisonous character of lead. Zinc covers more surface than lead, but does not cover it as well. Zinc takes up more oil than lead. It is also a poor drier, and this must be taken into account when using it. Use driers more liberally with zinc than white lead. Lead and linseed oil are both natural driers, and hence lead oil paint needs little drier on inside work.

Where an oil tinted job is to be done and the work is in fair condition, and one coat will not do, let the first coat be light and made somewhat flat, then the second coat may be made of oil, not very stout. The result will be a nice glossy job, solid and smooth. First sandpaper the old work, dust off and putty up

any defects. Never apply more paint in any case than may actually be needed. Thin coats of paint look better and wear better. This applies to inside and outside work alike.

Painting In Cold Weather.—Many painters are careless in the fall and winter. They are in such a hurry to cover the surface, get the job done, that they do not brush their color out even enough. You cannot be too careful in applying paint in frosty weather. If not properly brushed out, paint put on in cold weather will, upon your return the next day, present a wrinkled appearance, through the over-surplus of paint left on, having been affected by the frost.

Painting Old Weatherboarding.—For very old weatherboarding the following is a good formula: Take 20 pounds of whiting and mix it into a stiff paste with one-half water and one-half benzine. Break up 50 pounds of white lead and add this to your whiting, paddle it till it is a stiff paste, then thin with one-half linseed oil and one-half sweet milk. Put in the milk first, a little at a time, so that it will be absorbed before putting any more in. Apply with a brush the same as any other paint, being careful to keep it even.

You will find that this will slip much easier than ordinary paint, and you will be surprised at what a good surface this will leave. Second-coat with straight white lead and linseed oil. You will find that you can get a smooth, good-looking and durable job with two coats; where it would take three if you used straight lead and oil, and even then it would not be as smooth.

If pure primary colors are required to be applied with the full depth of tone, the painter must not make the mistake of adding white lead or any other white

base to lighten it, since the addition of any solid base to a semi-transparent pigment will ruin its luminosity, or, in other words, the amount of light that it reflects from its surface. Of course, what is here alluded to is the depth of a solid color, such as red, yellow, or blue, as it would appear when painted. If, however, the real depth of any pure color is required, such as we might see if the same color was thinned to the proper consistency and viewed through a glass vessel, then we could only obtain this effect by glazing—that is, by applying a suitably colored ground many shades lighter than the desired finish, and sometimes of a different color, according to the result desired, and upon this to apply a transparent coat of the real color. When red, yellow or blue paints are required they must be mixed from the pure primary colors in the same manner as the preceding example of white paint; thinning according to the effect desired. In wintry weather and when using dark colors, a liquid instead of a paste drier may be used with advantage.

Regarding red lead as a primer, we no not know that it possesses any advantages over white lead as priming for ordinary wood work. Most painters omit red lead from priming, and possibly the work is just as good without it. For hard wood its use in priming is advisable. Red lead, it is true, gives a harder surface than white lead; but this is sometimes a disadvantage, especially when a long period is allowed to elapse before second coating. In this case the priming gets so hard that it has no affinity with the coats which follow. The result is blistering. Doors and window frames which are generally primed prior to being built into a house, will be frequently found to blister when subsequent coats are applied. These blis-

ters go not to the wood but to the priming, showing that the trouble is not that the priming does not hold to the wood, but that the second coat does not hold to the priming.

The priming, or first coat of paint on outside work is very important, for upon its character depends the future life of paint, granting that other things are equal. The pigment should be white lead of the very best quality; the lead should then be tinted with color to agree with the finishing color. The lead should be mixed with pure raw linseed oil, adding a little japan drier of the best quality. A mistake is often made in adding far too much driers. The effect is to dry the paint before it has full opportunity to penetrate the wood as fully as it should. An article recently appeared in a paint trade magazine advocating that the wood be made wet with water before the priming coat is applied, the theory being that then the lead and oil will not sink away into the wood and be lost, but will remain on top and form a good surface for the succeeding coats.

Two-coat Work as Compared With Three.—Experiments have shown that three coats of paint properly applied are in every instance far better than two. In tests of outside white, where the coats were put on with the proper reduction, a pronounced lack of hiding was noted. To overcome this deficiency in another series of tests the paint was flowed on heavily, while in a third the paint applied was heavy bodied.

The last two tests did not wear as well as the first, suggesting the lesson that it is always necessary to thoroughly brush out the paint, applying a minimum coat rather than the heaviest possible. Furthermore, it proves that two properly applied coats, while making

a film lacking in hiding, will wear better than the two heavy coats, and finally it shows that three coats are far superior to two, whether considered from a decorative or protective standpoint. These tests further demonstrated the object in mind of obtaining a foundation within the lumber rather than a coat possessing hiding properties.

The surface for repainting on a three-coat test was very good, while that of two coats was unsatisfactory and of a treacherous nature.

Service of White Paint as Compared With Tints.—A lesson which is of interest to the property owner, and which the master painter should bear in mind when advising a prospective customer regarding a color scheme for his home, concerns the very noticeable difference in wear between a white and tinted paint. Practical tests have consistently demonstrated the superiority of tints over an outside white.

Although several explanations have been suggested, no conclusive evidence has been advanced that will satisfactorily account for this condition. In gray tints the addition of lamp black, which is in itself a durable paint pigment; or in reds or yellows the addition of the natural oxides, pigments which also give good service, may account for the improvement in wear. One point which has been established in this connection is that the finest ground oxides influence the longest wear.

It is especially noteworthy that while white paints on a test fence showed marked disintegration at the end of three years, a red and green color are in good condition at the end of that time. The latter retain their original color, have a good general appearance and show no signs of deterioration.

Wherever a colored paint can be consistently used it will prove advisable from a decorative standpoint, and furthermore, because of longer service it has the still greater recommendation of ultimate economy to promote their extended use.

Turps on Outside Paint.—A little turpentine added to outside paint is all right, and may serve a good purpose, but we would not use it excepting in special cases, say in winter, when it would help harden and dry the paint more quickly, as oil paint dries very slowly in very cold weather, though that is no fault, and is objectionable only when you want to apply another coat and finish up the job. Then in priming coats whether to use some turps or not will depend upon the sort of wood we are dealing with. A soft wood should have no turps added to the primer, while a hard wood, like yellow pine and some kinds of cypress, should have some. Turpentine may also be used in connection with boiled oil for outside painting, as it makes with the oil a denser film of paint than the oil alone; it hardens the paint, and makes it much more water-proof. Again, if considerable driers are used in the outside paint, then omit all turpentine.

"I don't see how anyone can successfully do a three-coat job without using turpentine in the first and second coats. It can be omitted in the last coat. I am often limited to two-coat work, and in that case I get along without turpentine, excepting in cold weather. I think the trouble some are having with wrinkling and crawling is caused from the lack of turpentine in the under coats, especially so with dark colors and boiled oil. I use raw oil for everything possible—I like it best for many reasons."

It is useful, many of our best painters say, in paint that is to go under porches and on the north side of

houses. It certainly hardens the paint, and if a good gloss is desired in the last coat, it may be well to put a good deal of it in the preceding coat, though where raw oil is used this will not by any means be necessary, if you will allow the preceding coat plenty of time to dry and harden in. In fact, allowing a week, or even more, for each coat to dry in would give as hard a surface as could be desired. Then there is the matter of cost; turpentine is very expensive these days, and if we can do without it we should, or use a good substitute.

Sizing Knots.—Gum shellac dissolved in alcohol and applied thin will usually suffice to prevent the rosin or turpentine in the knot from coming through the paint, but it is not sure where the sun can get at it, for the heat will draw the sap through the shellac, and raise a blister. Even when the knot is sized with oil size, and gold, silver or aluminum leaf is laid, the sun may raise it. Some add a little red lead to the shellac, both for inside and outside use. For inside use, glue and red lead make a good knotting. The very best way to treat knots is to apply heat, say a hot iron, and draw the sap, all you can, and then oil-size the knot and lay on a leaf. Or draw the sap and give it a coat of shellac varnish.

White or bleached shellac has less strength or sizing power than the brown or orange shellac; the former is also sometimes adulterated with water-white rosin, and hence is still weaker. This accounts for some, if not all, cases where the paint over the shellac knots shows through in a year or so.

The following is from an old and experienced painter, who claims to have had good results from it: "Mix equal parts by measure of finely powdered red

lead, white lead, and bolted whiting with a third each of raw linseed oil, coach japan and turpentine, strain and apply."

Knots not only have to be sized to prevent exudation of sap, but they have ends of grain that are very porous, and hence a filling must be applied to prevent suction.

Another cause for knots showing through after having had one and even two coats of shellac may be ascribed to the condition of the lumber, which is usually far from being dry, and shellac, particularly white shellac, is weak in the presence of dampness. Where the paint is dark enough you can use orange shellac, and this is much better than the bleached shellac, as already pointed out.

The mixture of red and white lead and whiting, previously noted, it should be explained, is to be mixed to about the consistency of stiff paint, and run through a fine mesh strainer; apply two coats for best results, before priming.

There is nothing better to apply on ordinary knots and pitchy places in boards than good grain alcohol shellac. Two thin coats of the shellac is much better than one heavy coat. Particularly bad knots are surely killed by covering them with some good outside varnish or gold size and letting it remain until "tacky," then laying on medium tin foil and burnishing. Let this dry thoroughly before applying the paint.

Winter Painting.—Whether exterior painting in cold weather is as durable as when done in the springtime depends a good deal upon the weather. As long as the temperature is above the freezing point, and the atmosphere is dry, so that the paint does not require too much turpentine to keep it from creeping and make

it work easy, and if the paint is well rubbed out, there will be no trouble about its wearing. But paint can never be applied successfully to a frosty or damp surface. It requires a little larger proportion of turpentine for thinning the paint for cold weather work in order to counteract the tendency of the oil to congeal or thicken. Winter painting also requires a little extra brushing.

If you use kettle boiled linseed oil for winter painting, we would add just a little drier—about one-fourth of a pint to one hundred pounds of lead.

Where raw linseed oil is used, our specifications show for *old* outside work one pint of pure turpentine japan drier to one hundred pounds of lead for both priming and finishing coats. For *new* outside work to one hundred pounds of lead one and one-half pints of drier may be used for each coat. In winter use one-fourth to one-half pint of drier additional for any coat.

Generally when the gloss is taken off of paint by frost it is only the surface gloss, and probably does no harm, and the gloss may be restored by rubbing over the spots with a cheesecloth moistened with raw linseed oil, a little turpentine and drier.

Amount of Time Between Coats.—Linseed oil in drying takes something from the air, viz., oxygen, and gives off something to the air, viz.: carbon-dioxide and water. Mulder describes the process beautifully, and calls it "the breathing of the drying oils." The things favorable to the drying of oil paints are light, pure dry air, and moderate artificial heat. The things unfavorable to the drying of oil paints are a humid atmosphere, darkness, noxious gases, and low temperature. The amount of time which should be allowed

to elapse between coatings of any given oil-paint will vary so much with the location of the structure, the kind and condition of the surface, the quality of the paint, the atmospheric conditions when the painting is done, that it is obvious no set period of time can be named. However, a painter who is interested in his work can always determine whether one coating is fit to receive another by noting its luster, the time when the paint no longer sticks to the dry skin of the finger, and the time when the layer cannot be removed under heavy pressure. Blistering, cracking, and peeling of paint are often due to the fact that under coats were too elastic when they were painted over. If a piece of work be painted coat upon coat of oil color before each coat is sufficiently dry, the movement and shifting of the under coats in their effort to obtain oxygen for their proper hardening will either rupture, *i. e.*, crack, the top coats or lift them up in the form of blisters. Four days is not too much to allow for the proper drying of oil color which will nominally dry in twenty-four hours. The period may be shortened by additional driers, but a good rule is to allow all paint to stand four times as long as it takes to arrive at superficial dryness.

Doing a White Finish Job.—The first step in securing a good job of white inside finish is to see that the woodwork is perfectly clean and smooth, and that all knots and sappy places have one, or even two coats of white shellac; and if possible the entire surface should be shellaced, after which the job is ready for the priming coat of zinc white, with thinners of oil two parts and turps one part, mixed together, and just enough patent drier added to insure its drying in good time. When dry, make smooth with fine sand-paper,

dust off, putty up, then give another coat of white shellac. If you put the shellac on the wood first, all over it, the grain of the wood will be raised, and this will make it more difficult to make a smooth job. By putting on the zinc priming first you avoid this trouble. Now you may proceed with the successive coats of zinc, using less oil and more turps with each coat, the last coat being all turps, or dead flat. For a special fine job, have your zinc paint for the last coat mixed a day or two before. When ready to apply it pour off the turps and mix again with all turps, adding a little white copal varnish to bind the paint. This may now be coated with damar varnish, for China gloss. Or left flat. If you wish to polish the job, then more than one coat of varnish will be necessary, using polishing varnish.

Lead is often used for the first coat or two on such work, on account of its greater body, bringing up the work quicker, but it is safer to avoid all lead on such work, as it will discolor the job in time, and hence zinc is best, though it takes a coat or two more to get the same finish.

Method of Application Important. — The method of application is about as important as the quality of the paint used, for the reason that a layer of air and water which it may hold exists upon all surfaces. This layer of air prevents close adherence of the paint to the surface and it can only be gotten rid of by thoroughly brushing the paint out on the surface and in to the body of the material underneath. The personal equation always counts in painting, as it does in almost everything else. From experiments with an ocular micrometer in connection with a microscope, we find that single coats of the same paint may

vary in thickness from 1/5000 in. to 1/1000 in. The variations in thickness from these extremes and intermediate points are due to the varying pressure of the brush under the hands of the painter. Much of the poor work done nowadays results from the quality of the tools purchased by or supplied to the painters. We insist that a good workman to do good work must have good tools to work with, that is, brushes not over three and one-half inches wide and full or thick with good stiff bristles. For the highest class of work we prefer "pound brushes," that is, round brushes with good, stiff Okatka bristles in them, not less than six inches long. With one of these, properly bridled, a painter can do more and better work in a day than it is possible for him to do with the ordinary flat brush that is usually furnished him, and which costs a little less. The good workman will always pay special attention to the coating of edges, and those parts of a structure where water and dirt will lodge, and to the filling in of all crevices, beads, and mouldings, to prevent the incursion of water. These hidden parts are often the vital ones in bridges or in buildings of steel cage construction, and they are those which have the most vigilent and constant attention.—*Houston Lowe.*

Good Painting Rules.—The fundamental principle of good painting is that paint must be properly thinned and then carefully brushed out. It is better by far to have paint thinned with pure linseed oil and spirits of turpentine and brushed out too thin to cover well than to flow on thick coats of heavy paint which temporarily look better, but very soon are likely to induce cracking and peeling and forever after prevent the surface from being properly repainted unless all of the heavy undercoating is burned off or otherwise removed. Let it be remembered, then:

First—That to insure good results on new or very old, spongy surfaces there must be sufficient pure raw linseed oil used in the first and second coats of any paint to properly fill the wood and arrest the absorption of the oil and binder from the paint film, still leaving enough oil to bind the pigment thoroughly, and that where any new surfaces are hard and resinous a liberal percentage of pure spirits of turpentine must be added to the first and second coats to insure adequate penetration and assist the drying to a proper "face" or surface for recoating.

Second—That on all work which has been previously painted and presents a hard, impervious surface, equal parts of pure spirits of turpentine and pure raw linseed oil must be used in reducing the first coat to a thin consistency, to secure proper penetration and homogenous drying of the new coat of paint.

Third—That elbow grease must be used to spread any paint out into thin coats and brush it well into the pores of the wood. Unless so spread satisfactory results cannot be insured.

Fourth—That a much more satisfactory and durablue job can be done with a round or oval brush than with a long, wide wall brush.

Fifth—That under no circumstances should a new house be painted, inside or outside, before *wet basement or the plaster* has dried out. It should be borne in mind that every yard of green plaster contains nearly a gallon of water, and unless thorough ventilation is given and the moisture is allowed to evaporate and escape in that way it must necessarily escape through the wood (which may have been thoroughly dry when put on), and the result must inevitably be blistering or peeling.

Sixth—That painting during or following soon after dew or heavy frost or fog or in any heavy, damp atmosphere is likely to produce unsatisfactory results, as dry wood absorbs moisture very rapidly.

Seventh—Not to apply a coat of paint and let it stand a year or so before a subsequent one is applied, as it will have weathered sufficietly in that time to absorb some of the elasticity of the succeeding coats, so that the final coats cannot be so satisfactory.

Eighth—Again, don't apply a coat of paint and let it stand until it is bone hard before continuing the work; one coat should follow another within reasonable time until the work is finished. If the under surface is allowed to get too hard it will not have the proper tooth which would allow the succeeding coats to get a grip or hold on it.

Ninth—Yellow ochre and other oxides are totally unfit for use as primers on any work which will be subsequently coated with lead or zinc colors, for the reason that when mixed dry they do not combine readily with linseed oil, and many of the particles unless ground are never thoroughly saturated, the result being that after applied to the surface the absorption of the oil by such particles and the surface to be painted leaves the film of ochre or oxide without any binder, brittle and lifeless.

Painting Over Burnt Surface.—When painters are called upon to repaint a cracking and scaling surface, the only satisfactory way is to burn the paint to the bare wood. This leaves all of the surface practically new, and if the character of the work is understood, good results can be accomplished.

All paints when burned, however, do not leave surfaces in the same condition, and the character of the

same must be understood before the priming coat is mixed.

It has been my experience that boiled oil is not satisfactory to use in a paint applied over a burned surface—it does not penetrate but lays on the surface and will soon cause cracking. These troubles are then often laid to dampness or to the paint itself, but I am of the opinion that the true cause is from the paint not having been properly reduced or applied over the surface.

In painting over a burned surface, I secure the best results by using a thin priming coat mixed on the basis of about 6½ gallons of raw linseed oil and 1 gallon pure turpentine to 100 pounds of lead.

Second coat, 4 to 5 gallons pure raw linseed oil, ½ gallon pure turpentine to 100 pounds of lead.

Third coat, about 4 to 4½ gallons pure raw linseed oil, ¼ gallon of pure turpentine to the 100 pounds of lead.

Painters should exercise particular care when undertaking to repaint a house when the paint has cracked and scaled. It is dangerous to undertake a good job unless all of the old paint is burned off to the bare wood.—*Carter Times.*

Stock White Paint.—In making a white paint from pure white lead, for either interior or exterior use, it is best to weigh out a certain proportion of the so-called keg lead in a suitable mixing package, and with a stout paddle beat it to uniformly smooth appearance. Then, either for inside or outside use, add sufficient drying japan, selecting a paler variety for inside work, and as much spirits of turpentine as of driers, and beat the whole to a thick batter, in which all lumps have been broken up. See that the

sides and bottom of package are free from paste also. If this is not the case, take a large-mesh strainer and run the mass through the same into another package, meanwhile breaking up the lumps left in the strainer by means of a stubby brush. And if any paste adheres to the side or bottom of the first package, remove same with the aid of a long pallette knife and put it also through the strainer. Consider this then as stock white, cover it up to exclude air, and let it stand at least over night before thinning it finally with sufficient linseed oil for exterior use or with the necessary thinners for inside flat or gloss effects.

When thinned to the required consistency for application, the finished paint should again be put through the strainer, this time one with a finer mesh, say about 80 to the inch. This will insure fine, smooth work. If such pure white lead paint is to be tinted, do this before the final thinning and straining by having the necessary oil colors thinned to similar consistency as the white paint is to be when ready for the brush. By straining the thinned oil colors before adding to the white paint, much annoyance will be saved, because tinting colors containing small lumps of color or particles of skin will make a lot of trouble in throwing off the tint on straining the paint and producing streaks on the surface when not strained. All of the foregoing applies also to the treatment of zinc white and combination whites, when used either as white paint or as the base white for tints.

Using Ready-Mixed Paint.—Makers of ready-for-use paints give full directions on the can for the proper application of their goods. They advise getting a good foundation before applying the paint, fol-

lowing the practice of all good and expert painters. Stir the paint thoroughly in the can when ready to apply it. Use good brushes and do not be afraid to rub the paint into the surface. For first or priming coat on new work it is advised to add a pint of raw linseed oil to the gallon of the paint. For sappy or resinous pine use turpentine instead of oil for thinning. For painting over old work that is glossy, for the first coat, add a half pint of turpentine to the gallon of paint. If the old paint is not glossy, add nothing to the paint, but use it as it comes from the can. For any finishing coat add nothing to the paint but use as it is in the can. Two coats on old work will do. Never paint during frosty, foggy, or wet weather.

Adding Driers To Paint.—With the painter this is simply a matter of guesswork. As a rule he uses entirely too much. Certainly much more than is necessary. An old painter tells me that he never uses any driers in outside paint, trusting to the oil and lead and weather to effect drying. Not even in winter does he use it, and he states that his work stands better than most of that done by men who use driers. He attributes much of the paint troubles, such as wrinkling, poor or uneven drying, etc., to the excessive use of driers.

While we do not follow his example, believing in the judicious use of good driers, yet there is no doubt than many times we might omit the driers and have a better job for it. Take tin or other metal roofing, for instance, and in dry or warm weather the paint will dry soon enough, without the assistance of driers. We must take the weather into consideration. When flies are bad, or wet weather or showers imminent, we must hurry up the paint, to save it from disaster.

Driers vary so in strength that it is quite useless to say what proportion should be used in any case. Some say that a half pint to the 100 pounds of lead is sufficient. No doubt this will be found sufficient for average and ordinary use. Yet we see as much as one quart advised, the paint makers being among those who advocate liberal use of the drying agent. Years ago, when in the painting business, I always found that a pint of ordinary japan was sufficient to the hundred weight of lead. And in summer, one half this quantity was ample. This seems like light using of japan driers, but it did the work.

When, in warm weather, you find the paint pot and brushes all gummed up with paint you may know that you are using a very great deal too much driers. At such a time you would find it much better to omit the driers entirely, or at least to use very sparingly, say a teaspoonful to the pot of paint.

The too free use of driers is also thought to induce mildew where conditions of dampness obtain. It is known that a paint that dries too soft or spongy will mildew where the conditions favor mildew, and we know that too much driers in paint make the paint soft, or spongy.

Before adding japan to the paint thin it a little with turpentine, which will make its mixing with the paint easier. The japan, however, will not require this.

Considering the small part it plays in the cost of paint, it is wise to use only the best turpentine japan driers. When twenty cents worth of driers will suffice for say 100 pounds of lead, it would seem that only a fool or ignoramus would buy or use a cheap grade of driers. I have just examined some that seems to be thinned with coal oil, and yet it was sold

for the best. Such driers will injure any paint, but more particularly good paint. Use only the best.

THINNING PASTE PAINTS.—In addition to the ready-for-use paints made by paint manufacturers there are also paste goods, white and colored. No fixed rule can be given for thinning such paints, the amount of thinners depending upon the nature and condition of the surface to be painted, and also upon the composition of the paint. But the following figures may prove useful:

For priming new wood add from 25 to 50 per cent. of raw oil.

For average exterior work 25 pounds of paste paint will take about five quarts of raw linseed oil and one gill of driers. This will make two gallons of mixed paint weighing about 17 pounds to the gallon.

For 25 pounds of paste white, not all white lead, the oil and japan will be as for the above formula, and will make about $2\frac{1}{8}$ gallons of paint, weighing $16\frac{1}{4}$ pounds to the gallon.

For 25 pounds of pure American zinc white add $1\frac{5}{8}$ gallons of raw linseed oil, and $\frac{1}{2}$ pint of best japan drier. This will make nearly three gallons of paint weighing $13\frac{1}{4}$ pounds to the gallon.

HOW TO THIN ZINC PAINT.—Use as much oil and as little turpentine as possible. Use pale boiled oil. Apply the paint in full or round coats, as all zinc paints can be used much rounder than lead paints, without any undue tendency to drag or pull. Ordinary raw or boiled oil will not dry zinc paint well, owing to zinc being such a poor drier.

To mix a pot of white paint in oil, have ready two clean paint kettles. Into one place about seven lbs. of

white lead and two ounces of driers for each pound of paint required. To this add a small quantity of linseed oil, and then beat up the mixture into a stiff paste. When throughly mixed add more of the oil, and then strain the mixture into the second kettle. It should now be thinned with linseed oil to the consistency for use, and would be termed a "full oil coat."

When a keg of white lead has stood for some months the lead becomes denser, owing to the soaking away of the oil into the wood. In this condition, while it has undoubtedly improved in quality, it has at the same time made it more difficult to work it up into a smooth paint. To remedy this to great extent take a stout narrow paddle, and put it into the lead, till it strikes the bottom, then work it back and forth, from side to side, for a few times, and the mass will soon become quite plastic, and then it may be moved into pots for further breaking-up and thinning for use. This will save much time over the usual way of first taking the lead out of the keg, and breaking it up in the pot.

White lead should always be beaten up before adding thinners, and then the japan should be added and be well beaten up with the lead; after which, if possible, let the mass stand a few hours; then the thinners may be added to the desired amount. This will render the straining of the paint unnecessary, unless skins are present. If colors are to be added, better beat up the colors separately, and thin out so that they will unite readily with the paint.

GOOD PAINTING DIFFICULT

T is a well known fact that conditions surrounding painting are yearly becoming more difficult to meet, for several reasons. First, the character of lumber now being used for many so-called first-class structures is in reality the forest culls left standing on the stump or unmilled when the prime timber was taken off only a few years ago. A great deal of such timber is sappy, full of wind shakes, knots, etc., and is frequently soft and punky, through long waterlogging or partial decay.

Again, on account of the scarcity and high price of lumber, many varieties of woods are being utilized for exterior siding which only a few years ago were regarded as wholly unfit for such use, among which we might mention the yellow and other hard pines, spruce, cypress, cedar, basswood (linn), gum, redwood and other similar woods which are either full of rosin and pitch or are very soft and spongy by nature.

In addition there is a scarcity of properly seasoned lumber. Much that is employed is either so full of sap or moisture that it is bound to make any paint peel as soon as the moisture is acted on by the sun. Again, other lumber has been so excessively kiln-dried that it is as absorbent as a sponge, and unless any paint applied on the same has been well thinned with pure linseed oil with the addition in some cases of pure spirits turpentine to assist in penetration, and thoroughly brushed out, in thin, even coats (not flowed on with a wide brush in thick, heavy coats, as is so frequently done) the soft, extra dry surface soon soaks up the

liquids entirely and leaves the film of pigment with an insufficient amount of oil to enable it to bind to the surface; and here again peeling is very likely to ensue.

Very frequently no thought is given to the proper thinning of paint to be used on yellow pine or similar woods "fat" with rosin, and paints are "regularly" applied to such surfaces with the result that the action of the sun on the outside of the paint film soon draws the pitch out of the lumber and the full oil coat of paint, lacking penetration, can do nothing else than let go and peel off—a result which might have been avoided by the intelligent use of pure spirits of turpentine in connection with pure raw linseed oil for thinning the first and second coats.

Let it be remembered, then, that to insure good results on new or very old, spongy surfaces, there must be sufficient pure raw linseed oil used in the first and second coats of any paint to properly fill the wood and arrest the absorption of the oil and binder from the paint film, and still leave enough oil to bind the pigment thoroughly, and that where any new surfaces are hard and resinous, a liberal percentage of pure spirits turpentine must be added in first and second coats to insure adequate penetration and assist the drying to a proper "face" or surface for recoating.

That on old work that has been previously painted and presents a hard, impervious surface, equal parts of pure spirits turpentine and pure raw linseed must be used in reducing the first coat to a thin consistency to secure proper penetration and homogenous drying of the new coat of paint.

That "elbow grease" must be used to spread any paint out into thin coats and brush it well into the pores of the wood, and unless so spread, satisfactory results cannot be insured.

That a much more satisfactory and durable job of work can be done with a round or oval brush than with a long, wide wall brush.

That under no circumstances should a new house be painted before wet basements or the plaster have dried out. It should be borne in mind that every yard of green plaster contains nearly a gallon of water, and unless thorough ventilation is given and the moisture is allowed to evaporate and escape in that way, it must necessarily escape through the siding (which may have been thoroughly dry when put on) and the result must inevitably be blistering or peeling.

That painting during or following soon after a dew or heavy frost or fog, or in any heavy, damp atmosphere, is likely to produce unsatisfactory results, as dry siding absorbs moisture very rapidly.

That to the greatest extent possible, painting in the direct heat of the summer sun should be avoided. Paint on the shady sides of a building as much as can be done.

Painting around fresh mortar beds should be avoided on account of the tendency of the oil in any paint to absorb the moisture and fumes from the lime, destroying the life of the oil and causing the paint to flat out and perish.

Remember not to apply one coat of paint and let that stand a year or so before a subsequent one is applied. It will have weathered sufficiently in that time to absorb some of the elasticity of the succeeding coat, so that the final result cannot be satisfactory.

Again, don't apply a coat of paint and let it stand until it is bone hard before continuing the work—one coat should follow another within a reasonable time until the work is finished. If the under surface is allowed to get too hard, it will not have the proper

"tooth" to allow the succeeding coat to get a "grip" or hold on it.

Leaky roofs and gutters and broken-down spouts are responsible for many a case of blistering or peeling which might, without investigation, be attributed to the paint.

Specifications for Outside Work

It must be understood that these specifications are only general. The kind of work, the condition of the surface, the weather, and so many things must be taken into consideration that it is impossible to give any formula which will suit every case. Some variation may be expected in the thinning qualities of linseed oil, hence the proportions given cannot always be followed exactly.

Bass wood, white pine and poplar absorb oil readily, and we suggest that more oil be used on these woods than on hemlock, yellow pine and spruce.

All nail-holes and other defects in surface should be puttied thoroughly after the priming coat is dry. A good reliable putty is made with pure linseed oil and equal parts of lead and whiting. The addition of litharge assists putty to dry and harden.

Before any paint whatever is applied it is essential that the wood-work be thoroughly dry. Under no circumstances should paint be applied when it is raining or snowing. All knots and sappy places should be varnished with the best grain alcohol shellac. Go over the surface carefully before painting and see that all dirt and dust is removed, also old paint scales, etc. A wire brush is probably the best for removing scales. Occasionally a paint burner is required where a job has been done with sub-

stitutes for pure white lead. It is almost impossible to do a good job of painting over a surface that has cracked or scaled. If the new coat is to be applied over an old coat of white lead paint, you won't find any scales or cracks. First use No. 1 sand-paper freely, then dust off well and your surface is ready.

OLD OUTSIDE WORK

First Coat—100 lbs. white lead, 4 to 5 gals. pure raw linseed oil, 1 gal. pure turpentine, 1 pint pure turpentine japan.

Second Coat.—100 lbs. white lead, 3½ to 4½ gals. pure raw linseed oil, 1 pint pure turpentine, 1 pint pure turpentine japan.

NEW OUTSIDE WORK

First Coat—100 lbs. white lead, 6 to 7 gals. pure raw linseed oil, 1 to 2 gals. pure turpentine, 1½ pints pure turpentine japan.

Second Coat—100 lbs. white lead, 4 to 4½ gals. pure raw linseed oil, 1 pint pure turpentine, 1 pint pure turpentine japan.

Third Coat—100 lbs. white lead, 4 to 5 gals. pure raw linseed oil, 1 pint pure turpentine, 1 pint pure turpentine japan.

Additional driers.—In winter and when the weather is damp, use ¼ to ½ pint additional turpentine japan for any coat.

Specifications for Inside Painting

OLD INSIDE WORK

Priming Coat—100 lbs. white lead, 1 gal. pure linseed oil, 2 gals. pure turpentine, 1 pint pure white turpentine drier. If old paint has high gloss, add ¼ gal. white mixing varnish to prevent crawling.

Finishing Coat—Full Gloss—100 lbs. white lead, 3½ to 4½ gals. pure raw linseed oil, 1 pint pure turpentine, 1 pint pure white turpentine drier.

Finishing Coat—Egg Shell Gloss—100 lbs. white lead, 3 gals. pure turpentine, 1 pint pure white turpentine drier.

Finishing Coat—Dead Flat—100 lbs. white lead from which the oil has been drawn, 3 gals. pure turpentine, 1 pint pure white turpentine drier.

NEW INSIDE WORK

Priming Coat.—100 lbs. white lead, 5 to 6 gals. raw linseed oil, 5 gals pure turpentine, 1½ pints pure white turpentine drier.

Second Coat—100 lbs. white lead, 1 gal. pure turpentine, 2 to 3 gals. pure raw linseed oil, 1½ pints pure white turpentine drier.

Finishing Coat—Gloss—3 lbs. white lead broken up smooth with turpentine, 1 gal. white enamel varnish.

Finishing Coat—Egg-shell Gloss—100 lbs. pure white lead, 3 gals. pure turpentine, 1 pint pure white turpentine drier.

Finishing Coat—Dead Flat—Same as for dead flat finish, "Old Inside Work."

For Either Old or New Work.—To secure a clear white or a delicate tint which will not turn yellow, use no oil except in the priming coat. For a flat finish mix second and third coats for new work, and both coats for old work as follows: 100 lbs. white lead, 3 gals. pure turpentine, ½ gal. white mixing varnish. If more gloss is desired, increase the proportion of mixing varnish and reduce the quantity of turpentine.

PLASTER WALLS

Priming Coat—100 lbs. white lead, 8 gals. pure boiled linseed oil, ½ to 1 gal. pure turpentine. Follow

the priming coat with a coat of weak glue size, which must be allowed to dry thoroughly.

Second Coat—100 lbs. white lead, 1½ gals. pure raw linseed oil, 1½ gals. pure turpentine, 1 pint pure white turpentine drier.

Finishing Coat—Dead Flat—Same as for dead flat finish, "Old Inside Work."

Finishing Coat—Egg-shell Gloss—100 lbs. white lead, 2 gals. pure turpentine, 1 gal. raw linseed oil, 1 pint pure white turpentine drier.

Finishing Coat—Full Gloss—100 lbs. white lead, 4 to 4½ gals. pure raw linseed oil, 1 pint pure turpentine, 1 pint pure white turpentine drier.—*From Carter Times.*

Burning Off Paint

Some painters, particularly the old-timers, think nothing so effective as the torch for burning off with, and there is no doubt about its efficiency. The main objection is the fire. It is liable to cause the burning of a building, as we know has occurred time and again. True, it may have been the carelessness of the workman, but that avails not in its favor, for we have careless workmen always. As to the legal aspect of the case. I believe that rules of insurance companies and laws, too, vary in different states, so that it is necessary for a painter to make inquiry in his own state. Ask the insurance man nearest to you.* Then, we

*The use of a benzine or naphtha torch to burn the old paint off a building preparatory to repainting has been held to be an increase of risk which voids the policy. An essential element in the case, however, is that the owner of the building shall have knowledge that such a torch is being used. If painters should use a naphtha torch for the purposes mentioned without the knowledge or consent of the owner of the building and the party holding the policy, the companies would probably not be able to escape liability. But when the owner is aware of what is going on and permits it he forfeits his insurance.

should be careful to examine the work, if it is old and flimsy, there is greater danger than in the case of the newer or more substantial house. Don't burn off on a windy day. Choose a still day, and avoid burning off on the sunny side of a house in warm weather, as men will likely be more careless when over warm.

Instruct your men to take it easy and let the torch do the work. Take the torch in one hand, and a broad knife, not too sharp, in the other. It is well for the men to wear a canvas glove on the hand with the knife to protect it from getting scorched, and he can work to much better advantage. Keep the nozzle of the torch an inch or two from the paint—always throw flame downward on siding. Set your broad knife back of the flame, not too slanting, and just shove. Don't try to cut it off. When the paint is soft enough it will come off easy. Don't push and pull your knife in short strokes; you will get too much old paint on the under side, and it will slip over it all. Let it follow the torch for a stretch of two or three feet. If the torch did not soften some spots, and your knife slipped over, just go over that two or three feet again.

If you have mouldings, columns, etc., to burn off, instead of a knife, use a wire brush, and as soon as the paint is soft give one quick forward and backward stroke. To remove the soft paint you can do a nice, even job in this manner.

After you have burned the paint off, sandpaper the work smooth, shellac the knots and prime with lead, three-quarters oil, one-quarter turpentine. If the old paint is cracked and too dry to soften under the heat of the torch, it is well to give it a coat of linseed oil the day before you start burning.

An old painter says: "In regard to removing paint from work which has to be repainted, I have yet to

find anything that will answer our purpose so well as the burning-off process."

We have now reached the time when a competent workman, with the torch in its present state of perfection, can accomplish more work in one day than two with any of the liquid removers now on the market, and at the same time make a cleaner and cheaper job, as when you add the cost of the liquid removers to the workman's time, doing a certain work, you will find you have made a considerable saving in this process.

How to Clean a Torch.—If the burning-off lamp does not work freely and with some force, it is waste of time to keep pricking at the nipple with a needle, and hoping it will get better. Take the top off with a wrench, and unscrew the nipple with stout pincers, and you will probably find it was choked with grit. Be sure to have it screwed up tightly before using again.

Burning off should be done by the day.

Plumbers have largely abandoned the gasoline torch for the kerosene torch, which is much safer.

While burning off with a torch have a bucket of water near by.

The tenant might sue the painter for damages if his torch fired the premises and invalidated the insurance, but the property owner could not.

There are cases where it would be cheaper to put on new weatherboarding than burn off or remove the old paint.

If there were no removers on the market, the insurance men would allow us to burn off the paint, as formerly.

It will cost about $1.00 per square yard to remove old paint with commercial removers.

It is found that paint removers cannot well be used in the sun, but they do all right on the shady side of the house or on a cloudy day.

In some cases some removers will work as quickly and as economically as the torch.

A master painter tells of one house where 200 gallons of paint remover were used to remove only part of the paint.

It is generally considered by painters that paint removers are slow and expensive. With gasoline at 20 cents a gallon, the cost of burning off with the torch is very little.

For one thing, painters do not make their charges on a basis like that used by plumbers, who charge for using 10 gallons of benzine when they use only one quart, or perhaps less, and even charge for so many feet of wick, and double rates for the helper, with an extra charge for the oxygen consumed during the time the torch was in blast.

How to Use Paint Remover.—Use plenty of remover and give it time to do the work. It is economy. as it saves time.

When applying remover, flow on, using brush one way.

Do not brush back and forth over surface after remover has been applied; as this destroys part of the solvent power of the remover.

If the first application of remover does not dissolve or soften the old finish clean to the wood within a few minutes, do not try to remove part of the old finish before applying more paint remover. Continue to make applications of the remover until old finish is soft through to the surface to which it adheres. For ordinary work one application, if allowed to remain on the

surface from three to fifteen minutes, will be sufficient.

On out-of-door work and on upright work, use the thick remover, variously called paste, semi-paste, syrup or cream removers. If your dealer does not have the thick kind, ask him to order it from one of our licensees.

If you want a slow drying remover, one that will remain moist for a day or more, ask for the thick kind.

Let the remover do the work of softening the old finish. That is its particular job.

A hard coating of old paint was removed from an old tank, says *Engineering Review,* with a paste made from fresh slaked lime and concentrated lye, mixed, and spread over the surface one-eighth inch thick, using a trowel for the purpose. After having been on long enough to soften the paint clear to the iron, it was removed with a jet of water from a hose; what was left was scraped off with a scraper. Two applications of the remover might be needed in very stubborn cases.

Take eight parts of fresh slaked lime and one part of pearl ash; mix and add water until the mass is about the consistency of oil paint. Apply this with an old brush. In about 16 hours the paint can be removed by scraping, after which wash off clean and neutralize the lye with vinegar.

Take a box of concentrated lye, and mix with a half gallon of water, rain water being the best; let it stand until thoroughly dissolved. Use a swab for applying this.

For paint that is not so hard take four parts of Fuller's earth, one part of soft soap, and one part of soda or pearlash; mix with boiling water. Apply, allow to dry, scour off with soap and water. If paint is very

hard, add fresh powdered lime to the mixture, and let the coating remain until the paint scrapes away easily.

Take soda and quicklime, half and half. Dissolve the soda in water, and then add the lime. Use an old brush to apply with.

For paint that is comparatively new, or not old and tough, take one pound of soda and dissolve it in hot water, and apply hot. Wrap a coarse cloth around a block and rub the paint off with this.

Make a paste with half a peck of freshly-slaked lime, twenty pounds of potash and eight gallons of water. Use same as in other lye formulas.

A painter says that an old weather-beaten building may have its paint removed by strong concentrated lye, allowing it to dry on and not wash it off, but painting over it. Which might cause the paint to be injured, by the remains of the lye acting on the oil in the paint; but the painter says not. Concentrated lye and caustic soda are one and the same thing. Caustic soda is cheaper than potash.

English Paint Remover.—An English patent. 300 parts of slaked lime are mixed with 75 parts of powdered sal soda or potash into which 60 parts of a mixture containing 60 parts petroleum oil, 300 parts alcohol or acetone, and 75 parts soap, all stirred together. May be thickened with 450 parts whiting. For removing oil paint only two minutes is required. Hard enamels, etc., will take upwards of two hours. Wash off with water.

Old paint on a door may be removed by steel wool or with sandpaper wet with benzine. Of course, there is also the paint removers.

Carbon tetrachloride will remove old paint, but is too volatile to use alone. On the other hand, it has

the property of rendering inflammable liquids safe when used in suitable proportions. It forms, with sulphonated oil, like Turkey red oil, a gelatinous soap which is perfecely homogenous, and will mix with water in all proportions. Such a solution, containing, for instance. 1 part of the said gelatinous soap, and $\frac{1}{2}$ to 1 part of water, when stirred up with 1 to 2 parts of carbon tetrachloride and mixed with alkali and spirit, will form a very good paint remover.

A remover may be made by dissolving caustic alkali in spirit. For instance, a solution containing equal parts of alkali and water is warmed with sufficient soap to form a gelatinous mass, and diluted with strong alcohol. The soap acts on a varnish covering paint, and thus exposes the paint to the action of the remover.

Cleaning by sand blast, although more expensive, is much more thorough than the hammer, chisel, scraper and wire brush method and the greater cost is readily offset by better results in the end. Where the sand blast has been used, the steel so cleaned, when shortly after properly painted, did not show signs of corrosion again nearly as rapidly as did the steel cleaned by hand.

PAINTING BY SPRAYING

THERE is quite a number of different makes and styles of machines on the market —low pressure, high pressure, air machines, power machines and hand pumps. The writer would recommend a hand pump carrying from 150 to 250 pounds pressure, as compact and light in weight as it can be made, consistent with durability, for this work. The machine question is quite a difficult one to solve, as most machines are made to sell and will need constant repairing or replacing of parts. This of necessity increases the cost of doing work and wants to be eliminated as much as possible.

A job of spraying, if properly done, is better than a brush job in several respects; it eliminates brush marks and laps and penetrates cracks and crevices that you cannot get into with a brush. In painting by machine one thing to be remembered is that the minute the machine stops all the work stops, and on difficult work it is frequently advisable to send an extra man to handle the nozzle so that the men can alternate and keep the machine going all the time, and you will by so doing more than make up the additional cost by the extra quantity of work turned out. Great care must be exercised in the mixing and straining, for if the paint is not properly mixed or not properly strained, the machine will be constantly clogged up, and this means a great loss of time in cleaning out the machine; another item one wants to bear in mind is to mix the paint as near the water in the building as possible and keep the machine where you are mixing, to save the

cost of carrying the water and paint around the building. The writer has painted six- and seven-story buildings by machine and never moved his machine out of the basement of the building, by using sufficient hose to reach the top floor and taking off unnecessary lengths of hose at the close of each day's work, when it is customary to clean out all utensils and prepare for the next day's work.

The writer has found it best to use at least four men on one machine—two to alternate at mixing, straining and supplying the machine, and to do the pumping, and the other two to do the spraying, except on small jobs, where four men would not have a full day's work.

The greatest objection in the past to painting by machine has been the nipples, or drops left on the lower edges of beams and rafters, but this has been practically eliminated through practice, and to-day you can go through a building painted by machine by an inexperienced man and you will not find the same.

How much brush work is done when the machine is used? That is a question sometimes asked. In answer I would say that the only place that we use a brush at all is around windows and door frames; formerly we covered the windows and doors with paper of muslin, but that is now unnecessary, as an experienced workman can spray within four inches of the opening and not get any paint on the frames or glass.

What is the relative cost per yard, as compared with hand painting? Machine work can be done for one-half the cost of brush work on any job that is of fairly large size. On a room or ordinary small job there would not be this difference, for the machine is for large surfaces, as on factories, etc. For jobs of three or more days' work for several men you could do the

work for half what you would have to get for brush work.

The man at the spray end of the machine should be well experienced, but those who assist him need not be skilled men. The head man must know how to mix and apply the paint. The longer a man works at this the more expert he becomes, particularly at extension work.

Many painters condemn the spraying machine, some railroad foremen painters especially being hostile to its use, saying that the paint is thrown everywhere, and that it takes almost as long to clean up after it as to do the work. But probably they had little experience with the machine.

PAINTING BRICK WALLS

AINTING BRICK WALLS FLAT COLOR AND STRIPING.—The preparation of a wall for flatting is essentially the same as we have described for oil finish. In either case there must be good, secure foundation for the paint to rest upon. On new work two coats of oil paint, the second containing about half-and-half of oil and turpentine, is usually employed. If the latter is made perfectly flat, with all turpentine, it will not hold so well; some painters say that as much as one-half raw oil is not too much for the last or flatting coat, for while it will give some gloss, yet this gloss will wear off in time, leaving a flat effect. This is true in a measure, but we might suggest two amendments to the idea, namely, to use much less oil than one-half, or just enough to serve as an effectual binder, or use pigments ground in oil, the oil in these being sufficient.

For flatting work on bricks many apply only one coat of oil paint over the priming coat, but this will, and must depend upon the condition of the bricks. Usually, however, the two oil coats and one flat coat are enough.

A good red-brick color may be made from two parts of the best French ochre, one part of the best Venetian red, and one part of pure white lead. Varying these proportions will give light and dark brick reds. Add Prussian blue for very dark brick red. Mix in oil, and thin with turpentine, with sufficient driers to dry the work in a reasonable time. Use a broad bristle wall brush, and take down a side at a stretch across the wall, cutting in more or less evenly at the mortar line

at bottom. With enough men on the swing to take a stretch in this way, without the men moving from their positions, gives a perfect job.

Painting an Old Brick Wall.—The principal difficulty met with in painting an old brick wall is the tendency to blister or peel, and this may be avoided by the following method: Scrape the wall and scrub it with a stiff fiber or wire brush; then apply a coat of good paint of the desired color, thinned with raw linseed oil and a very little japan drier; brush this paint well into the bricks, and allow it plenty of time for hardening. For the next coat add at least one-third of white lead, no matter what the color is to be, and thin up with a mixture of two parts of raw oil and one part of turpentine, with enough drier to dry it hard. The third coat, or finishing, may be of any desired color, but should be thinned with good kettle-boiled oil and a very little drier.

The first thing to do is to get every particle of loose stuff from the walls, which may be done with a coarse fiber brush; then dust off clean. If you have a lot of old paint and enough to do the job, thin it down with oil and a little benzine, strain and apply quite thin to the wall. Brush this well into the surface, and let it have several days to become hard. The next coat should be lead paint, of fresh materials, with raw oil and just enough driers to dry it well in reasonable time. A little turps also will be an advantage. This will now give you a good foundation for whatever color or paint you may want to apply.

The various surfaces that we are required to coat with paint differ enough in certain characteristics and requirements that there can be no question about each requiring a special kind of paint: at the same time not

so much depends upon the kind of paint, we believe, as upon weather and conditions of surface. Take a brick wall, for instance; if it has been painted and new, and the bricks have not been laid very long, another condition confronts us. The wall must be perfectly dry before paint can be safely applied. Then any ordinary paint may be applied. That is, for the first coat plenty of oil must be added to the paint, as the bricks are more absorptive than wood. So with the next coat, only this may contain more pigment and less oil. Any defective places in the wall must be repaired with the proper kind of mortar. When dry, prime with nearly all oil, using Venetian red, but never ochre. After priming, all smaller defects may be puttied up. This should give a good, solid wall for subsequent coats. Cold weather is a bad time to paint brick work or other outside walls of like nature.

Preparing The Wall for Flat Work.—First make the brick work fit for the paint. Scrape and brush, as directed elsewhere. Fill all holes and cracks with putty or some sort of plaster or cement, if the breaks are very large. Add a little dry Venetian red to raw linseed oil, and give the entire surface a coating. Rub it in well, and give it full and plenty. The priming coat may be made in the proportion of about 20 pounds of Venetian red to 10 gallons raw linseed oil. Let this dry for about two weeks. Then apply a coat of paint made from Venetian red 75 pounds, best white lead 25 pounds, Indian red 3 pounds. Mix thoroughly, and let it stand 24 hours. Then mix for use, with raw oil and a little benzine or turpentine, to flatten it a little; benzine will not flatten as well as turpentine, but is cheaper. When hard-dry it is ready for the flat red coat and striping.

Painting over bricks is quite different from painting on wood. You must not make a long stroke with the paint brush, as you do on wood. Lay it off as the water color painter does. Take a long, full-stock wall brush, and use the tip of the brush, with about a six-inch stroke. Brush from the unpainted part into the painted part.

In making the brick reds, ochre is added to produce the lighter shades of color, with a little blue for the medium shades, while for the very dark shades much Prussian blue is added. The buffs, including Milwaukee color, are made from white lead and ochre and raw sienna, this giving any shade, from light cream to decided buff color.

We have seen it advised to use some brown soap in the last coat of flat finish, the advisor saying that it will increase the durability of the paint and help deaden the color. But our advice is against such a practice. Soap is a bad thing in any paint, and as for flattening, that is abundantly achieved with turpentine.

Lining Brick Joints.—This work requires care, if not considerable skill. By carefully following our directions, the average good painter should be able to do very nice job of lining work. The paint, saying we are going to use white, to imitate white mortar, is made from white lead mixed stiff with oil and a little drier, then thin down to a consistency rather stouter than ordinary paint, or it will run. Fill a pound paint brush full of this white paint, holding it in the left hand, which also holds the straight-edge, a narrow, bevelled slat, and with the liner, the brush used for the horizontal lines, in the right hand, dip it in the paint that is on the pound brush, and proceed to draw the liner evenly and gently, not hard, along the straight edge, which

is held true to the mortar line. Some employ a straight edge that has a level attachment, so that they will get the line level. But this is not necessary, as the mortar lines are usually on a more or less true horizontal plane. In the case of fine brick work, as the front of a pressed brick building, the practice is to run the lining on the top edge of the brick, just under the mortar. The reason for this, it gives a truer line, as the bricks are smoother than the mortar. The vertical lines of the mortar are made with a tool called a header. Thus there are headers and liners. The liner is a thin brush of hog bristles, two or three inches long, while the header is much shorter. The lines are run first, several of them, then the headers are used, to divide the bricks where they join at the ends. Care must be taken to run uniform lines, and you can do this by holding the straight-edge firmly at the level, and drawing the tool firmly yet easily along the straight-edge, as already explained. Do not bear on too hard, but with a uniformly even pressure, and keep the tool loaded with paint. White is almost invariably used for lining on red brick work, but on buff or Milwaukee work the lining is usually black, as this shows up better with the color than white.

Estimate of Paint Required—Of pure white lead, thinned with oil to the same consistency as is required for priming woodwork, one square yard of rough brick surface requires about one-half pound of paint, and very nearly as much for the second coat. The third coat will require very much less, and for the three coats you may estimate it to take one and one-quarter pounds. For painting a surface of smooth, pressed bricks laid up with close points, the quanity required for a given surface will be a little more than for painting new white pine wood.

Rejuvenating An Old Brick House.—In most of the older communities will be found a number of old red brick houses and store buildings, which have become worn and weather-beaten and have lost whatever attractiveness they once possessed.

Every old brick building is an opportunity for a painter, for probably there is no class of buildings on which paint will work a greater transformation.

A customer who has lived in such a house for years is usually best pleased when it is repainted a color as far removed from any resemblance to red brick as possible. And when it comes to selecting colors, the more nearly one approaches to the cream tint of clear Milwaukee brick, the better. An old brick house painted cream with a white trim is a combination in excellent taste, wears well, and makes a new house out of an old one.

It is a more or less common impression that paint adds nothing to the life of a brick wall. This is not entirely true, especially when soft bricks have been used. They absorb moisture readily, and freezing when the brick is saturated will cause chipping and shelling. White lead and oil paint will keep out the moisture and protect the surface from further damage.

The painting of a brick wall offers no particular problem. The one essential thing is to be sure that the brick work is thoroughly dry. A brick building should not be painted in winter, and in summer only after a week or more of dry weather.

Good results can not be expected from two coat work when painting brick work for the first time. A very thin coat of paint is required for priming—nine gallons of boiled oil and one gallon of turpentine to one hundred pounds of lead usually being the proper proportion. In the second coat—four gallons of oil,

one-third boiled, two-thirds raw, should be used to one hundred pounds of lead and the finishing coat should be even heavier.—*Carter Times.*

Absorption of Moisture.—It is said that a brick is capable of absorbing a pint of water, and that a driving rain will penetrate a brick wall ½ inch through. In a very cold climate damp bricks burst open in freezing weather. The brick walls of a house may contain tons of water, and probably does always contain more or less. This moisture causes efflorescence or salts to appear on the surface, one of the most common of brick wall painting troubles.

Green Mould, Mildew, Etc.—Washing off with an acid water and stiff scrubbing brush is the only cure. Sulphuric acid is usually recommended, but care must be used in adding it to water, dropping it in the water carefully, and not pouring the water on to it.

Cleaning a Smoked Red Brick Front.—In cities using soft coal the walls of brick and other buildings become black with soot. This may be removed as follows:

To one gallon of good soap, not too watery, add two pounds of powdered pumice, OO or F, and one pint of liquid ammonia. The article sold as household ammonia will answer, although it will be all the more effective if a little stronger. First remove as much of the soot and dust as possible with a stiff broom or fiber brush. Then apply the soap and ammonia mixed, with an ordinary fiber brush or common whitewash dip, and let it remain for about twenty to thirty minutes. With a good scrubbing brush rub it briskly, dipping the brush in clear water once in a while. Have

a few pails of water handy and a large carriage sponge to go over the scrubbed surface, and finally rinsing with clear water. If convenient, use a hose with spray nozzle for rinsing. This should remove the most stubborn case of staining from fire or smoke.

Dirty brick walls may be cleaned with soap and water and scrubbing, followed, after drying, with a solution of muriatic acid, making the water quite sour with acid. Use a whitewash or wall paint brush.

Cleaning Old Paint From Brick Wall.—Old paint may be removed with the gasoline torch or with strong alkali, or lye and lime paste, the job in any case being a difficult and more or less expensive one. Old paint will not need to be removed if firm and good, of course.

Never paint a brick wall in damp or cold weather. Take a dry time for it. If there is dampness in the wall it will show up later on in the fading out and peeling of the paint. Summer is the time for wall painting. If the flat brick paint is too dead flat it will not do as well as it ought; but by adding a little raw oil, or even up to a half-and-half proportion of oil and turps, it will make a more durable job, and any slight gloss seen at first will finally die away and leave a very satisfactory dead flat finish.

If a wall has dampness more or less permanently it should be treated for it, as the dampness will discolor the paint and cause it finally to decay.

To prevent the burning out of the color of the paint by alkali in bricks or cement surface on brick wall, apply a size of 20 per cent. dilution of muriatic acid. Wash off with clear water, and let the bricks or cement become perfectly dry before paint is applied.

Sometimes brickwork will turn black, but this does not often happen. The cause is not certainly known,

but impure oil or dampness may be the cause. It sometimes appears in spots on the work. Probably it is a mildew. Various remedies have been employed to cure or prevent the evil, but to no purpose. Kerosene has been applied over the paint, as a cure. Heavy coats of lead paint, containing some varnish, have been tried, but in vain. It occurs when the wall is perfectly dry, as well as when damp; and it occurs also in a warm, dry time of year, as well as in a damp period.

White On Brick Work.—There are at least three different causes for this. On new work, carbonate of soda is the most common, after the limestains have been removed. This is due to the action of the lime mortar upon the silicate of soda in the bricks. Silicate of soda seldom occurs in bricks unless the clay used is a salt clay. The only other white efflorescence of importance is composed chiefly of sulphate of magnesia. This is due to pyrites in the clay, which when burned gives rise to sulphuric acid, and the latter unites with the magnesia in the lime mortar. The conclusions arrived at are these: Efflorescence is never due to the bricks alone, and seldom to lime alone. To avoid it the bricks should be covered with an oily preservative capable of preventing the salts from exuding. Linseed oil cannot fill the requirements, as it is injurious to the mortar.

Cleansing Brick Work.—To clean yellow bricks from stain and smoke take freshly powdered lime and sift it; take 100 parts of this and add water to form a thin milk of lime; boil in a copper boiler, and add 1 part bichromate of potash. Now mix up some lead sulphate in water, making a thin paste, or use sugar of lead or nitrate of lead; any of these will answer the

purpose as well, and stir into the first mixture while boiling. Color with ochre to match color of bricks, then add cold water, after which run it through a fine sieve, drain it through linen cloth—a bag is good—and when all the liquid has drained out, leaving the residue, take the latter and break into bits, and dry in the open air. When wanted for use it may be mixed with water like lime, to form a wash, and be applied with a brush.

In many cases bad stains might be painted out.

To clean hard-pressed bricks, from water running over them and depositing iron rust, add 2 lbs. medium fine pumicestone powder to two quarts of soft soap and one-half pint of ammonia water, stir the whole and apply. Let it remain for 30 minutes, rub with a scrub brush, then sponge off with plenty of clear water. If this fails to remove all the stain then try oxalic acid 2 oz., butter of antimony 1 oz., dissolved in hot water, to which add to form a paste flour, and apply a stout coat of this, and after two days wash it off.

Efflorescence or white powder on bricks may be treated with hydrochloric acid and water, equal parts; let dry, then wash off with clear water.

Stains from paint or oil remove with a paste made from 2 parts whiting, 1 part soft soap, and 1 part potash, with boiling water to form the paste. Apply heavy coats of this, and after a few hours, remove same and clean bricks with soap and water, then wash off with clear water.

To remove white paint, make a solution of equal parts of sal soda and fresh lime, viz: Dissolve soda in as little water as possible, then add lime and allow it to slake. The mass should be like soft butter, and if too thick, then thin it with water. After it has softened the paint wash off with hot water.

To clean off pressed brick front, take a gallon of soft soap, 2 pounds powdered pumice stone, and one pint of household ammonia. Apply in thin paste form, with fiber brush, allow it to remain on about 20 minutes or so, scrub well with scrub brush, then wash off with clear water. Use plenty of clean water in washing off.

PAINTING OVER CEMENT

PREPARING THE SURFACE.—When Nature, in the form of wind, rain, and sunshine, has neutralized the alkalies of the cement, it is much easier to paint the exterior structure and secure more durable results. Consequently, it is unwise to figure upon having a stucco or concrete house painted when finished. If this is intended, the highest results cannot be expected.

Old concrete houses that have stood exposed to the weather for a year or two are in much better condition for the painting. The new house painted cannot undergo the same aging process. The film of paint is waterproof, and hence checks the process of neutralization of the alkalies in the cement. If the house has had an opportunity to dry thoroughly the question of painting the exterior surface to get another color can be considered with hope of success.

Nearly all of the different methods of applying paint to cement surfaces have been tried on new houses, and the experiments were conducted with the fresh concrete or stucco in view. Therefore, all of these apply with greater force to the houses which have been allowed to stand a year or two and dry out.

One of the earliest processes was to treat the cement surface and neutralize the alkali. Diluted muriatic acid of 7 to 8 per cent., mixed with water, composed this wash. After treating the entire surface, all dirt, grease, and other substances were removed, and the neutralizing of the alkali of the cement was hastened thereby. But, unfortunately, if the cement contains much lime, which is very commonly the case, the muri-

atic acid would tend to neutralize the lime and convert into calcium chloride. This would prove most injurious to the cement surface. It would crumble and pit the surface, and when paint is applied to such a surface it would have a very uncertain foundation. Any application of such a wash to the cement, therefore, means disintegration of both the surface and the ordinary paints. In the use of muriatic acid as a wash, and also sulphuric acid, which some have employed, an excess of acid is supposed to be washed off before the paint is used; but in spite of this the acid generally does injury to the surface.

There is a method called the zinc sulphate, which gives much better results than either of the former applications, and its cost is less. When the cement has dried properly an application is made of a zinc sulphate and water of equal parts by weight. When thoroughly mixed this solution is applied over the whole surface with a stiff brush. A fine coat is thus formed, which at the end of two or three days dries hard and firm. The zinc sulphate changes the caustic lime of the cement into calcium sulphate or gypsum, and zinc oxide is deposited in the pores of the cement.

Zinc sulphate is one of the most important of the white paint pigments, and when paint is subsequently applied, this becomes incorporated with it, and gives lasting and durable qualities. The zinc sulphate has no known injurious effect upon concrete or cement surfaces, and consequently there is no disintegrating chemical change set up. This method of treating cement surfaces to prepare them for painting has been used successfully on a great number of private and public buildings.

In preparing cement surfaces for painting, consideration must be observed as to the effect of the first ap-

plication may have both upon the cement and the paint. The strong acids that destroy the cement cannot be recommended anywhere.

There are several other methods of preparing cement and concrete for painting, so that durable color-effects can be obtained, and some of these have given excellent results. One of these is to coat the surface with a solution of 10 lbs. of carbonate of ammonia to 45 gallons of water. The solution is applied with a brush, once, and left to dry. Insoluble calcium carbonate is formed on the cement surface, and a large amount of ammonia is liberated. This leaves a perfect surface for painting. Where mortar containing lime is used in building a stucco house, it is better to use two weak solutions of this mixture rather than one strong solution. The surface of cement is not injured by this wash.

Waterproof Concrete Paints.—The committee on treatment of concrete surfaces of the National Association of Cement Users, has investigated a number of the so-called waterproof concrete paints and finds that they are much more efficient than colorless solutions.

These paints have been divided into two classes: First, those which give white, or light tints, or other colors pleasing to the eye and of a decorative nature; and, second, those which employ compounds of tar and asphalt which are necessarily black, or nearly so, and are, therefore, seldom used on exposed surfaces.

The presence of a finely-divided pigment serves to seal up the small pores in the surface of the concrete, leaving less work to be done by the vehicle.

In most cases the proportion of pigment used is small, and by using a cement color but little change in

the surface appearance of the concrete need be made, unless desired, while on the other hand, almost any shade of color may be obtained. In this way the waterproof coating is made more servicable and at the same time ornamental.

All these treatments are applied with a brush in the same manner as paint and are probably as durable on concrete as paint is on wood.

Linseed oil paints should not be applied directly to new concrete, or to any concrete which has not been long exposed to the weather. The free lime in concrete not thoroughly weathered out on the surface by exposure to the elements will saponify the oil, destroying its adhesive power and its life, and the paint will soon peel off. After concrete has been exposed for a long time to the elements, linseed oil paint may be used with greater safety. It is difficult, however, to determine when the concrete is sufficiently free from lime to render it safe for the application of linseed oil paints, and it is therefore safer to avoid their use directly on concrete.

PAINTING THE SURFACE.—The following have been given as corrected formula for painting on cement or concrete:

Priming Coat.—100 pounds pure white lead, 4 gals. pure kettle boiled linseed oil (or in place of that use 9 gals. pure raw linseed oil and three half-pints of turpentine driers) and 1 gal. turpentine.

Body Coat.—100 pounds pure white lead, 4 gals. pure linseed oil (1-3 boiled and 2-3 raw) or 4 gals. pure raw linseed oil and 1 pint turpentine drier.

Finishing Coat.—100 pounds pure white lead, $3\frac{1}{2}$ gals. pure linseed oil (1-3 boiled and 2-3 raw, or $3\frac{1}{2}$ gals. pure raw linseed oil and 1 pint turpentine drier), and 1 pint pure gum turpentine.

Notice that all the ingredients are to be the best of the kind. Zinc white is thought to be too hard for cement painting. Some painters prefer red lead for the priming coat, using this formula: 85 pounds pure dry red lead, 1 gal. pure kettle boiled linseed oil, and $\frac{1}{4}$ gal. turpentine. Red lead makes a more nearly impervious coating than white lead, and is also quite elastic. But the red is objectionable where light colors are to be used in the finishing coat, unless a good body coat is applied over the red lead paint, followed by a good finishing coat. Even then I believe there would be danger of the red affecting the finish color in time.

One man says he used a certain brand of cement coating and it did not last two weeks. He did it over again, his own way, using lead and oil, and he got good results.

Another painter says he uses neutral oil with a little drier and turpentine, which makes a good coating.

A German painter says that in "the old country" they took 25 pounds of white lead and 1 pound of beeswax and boiled both together. They applied this and it made a good coating, one that proved very durable.

The following method of painting a cement wall was described at a convention of Canadian master painters. The building had become discolored in places, and the joints were of a different color from the surface of the blocks. Two parts of Portland cement together with one part of marble dust, were mixed with water to the consistency of thin paint or a thick whitewash. The wall was well wetted before the application of this paint and kept constantly wet

while the material was applied, and then kept wet for a day in order to make the cement wash adhere to the cement surface. The wash was applied with ordinary whitewash or calcimine brushes, and a man was kept busy playing a spray on it while the work was being done. The whole secret of success lay in keeping the wall constantly wet.

Another man tells of doing a job on cement walls at the University of Cincinnati, with pure lead and zinc, just what proportions he did not state, and thinned with linseed oil, whether raw or boiled not stated. However, the paint was right, as it had to "pass analysis." In about five years the skim coat of plaster and paint all came off. The chemist then said it was a mistake to use linseed oil, because in time it contracts and pulls the skim plaster off. He thought a water paint with more binding matter might answer.

Here is a somewhat tedious method for preparing and painting cement, but it has the sanction of some of our best painters: Slake one-half bushel of fresh stone lime in a barrel, and add in all 25 gallons of water; when slaked, and cold, add six gallons of the best cider vinegar and five pounds of the best dry Venetian red. Now mix well and then strain through a fine wire strainer. Use it when about the consistency of thin cream. Give the cement surface a coat of this, and after standing a day or so apply a coat of red lead and linseed oil paint. After this has dried you may paint the surface any color you wish. Some jobs require two coats of paint over the red lead paint. In this case make the second coat of paint serve as filler and paint both. The second coat may be made with plaster of Paris and oil, of the consistency of butter-

milk. Then break up some white lead and oil to make a paint the same consistency as the plaster paint. Now take equal parts of each of the two mixtures and "box" them together, and thin to a working consistency with turpentine. This second coat should be applied as heavy as possible, or as heavy as you can spread it well. After this coat is dry apply your next and finishing coat of paint, which should be quite glossy, or about as you would for the last coat on woodwork outside. The object of giving it this plaster paint is to prevent the running and wrinkling of the paint where considerable paint is to be applied to the surface. And it must be made to dry quickly, so that you will not likely give the finishing coat before the second coat is dry enough, for if you do that there will be blistering or cracking. Observe particularly that no plaster is to go in the last or finishing coat.

Zinc sulphate and ammonia carbonate as applied to concrete, unless fully satisfied by the presence of calcium hydroxide are still soluble in water, and thus offer difficulties of a serious nature.

The neutralization of calcium hydrate and calcium oxide appearing on the surface of concrete does not always mean that the surface will remain neutral. Moisture finds its way from the inner portions of the block or wall and carries with it alkali—the foe to linseed oil paints.

The treatment with zinc sulphate or ammonium carbonate, even though successful, does not offer a solution to the problem, because a linseed oil paint is unsuited for either exterior or interior painting of concrete. The gloss robs the surface of the appearance of stone or masonry. Linseed oil has water-absorbing, and lacks water-resisting properties. It cannot

be applied over a damp or wet surface, which means that following a rainstorm or rainy season a painter must wait weeks and perhaps months before he can commence work on or complete a contract already begun.

A series of practical tests develop the fact that a wash of zinc sulphate or ammonium carbonate was a help in some instances, but the lack of uniformity in results, and low degree as well as non-permanency of improvement, demonstrated their inefficiency to cope with this important problem.

Colorless Liquid Coatings.—Certain of these may be of some value or service in retarding moisture, absorption and efflorescence, but they are all alike found lacking in the following respects:

They serve to emphasize any defects in, or difference in, color of concrete construction.

They impart to concrete a soggy, water-soaked appearance.

They do not render impermeable to moisture for any length of time.

They do not decorate.

Dust-Laying Compounds for Cement Floors.—The best we know of is to mix 25 pounds white lead in oil, 10 pounds yellow ochre in oil, and one pound lampblack in oil, adding about one quart raw linseed oil, beating all into one homogeneous mass, and while stirring it constantly add $1\frac{1}{2}$ gallons kerosene oil of 150 degrees and one-half gallon of the lime solution, as given below, let it stand about 30 minutes, then add from one quart to half a gallon brown japan and one quart fat linseed oil. This will make $3\frac{1}{2}$ gallons of coating to keep down the dust, and is unaffected by the

cement, and when worn somewhat any good floor paint may be applied over it without being affected by any causticity in the cement. The lime solution is prepared as follows: Pour three gallons hot water over 11 pounds of quick lime, which is in a suitable vessel, cover this with burlap or a sack to keep in the steam and let stand over night. Then decant the water and strain through several thicknesses of cheese cloth and bottle for use as above.

Testing Waterproof Paints.—A number of special coatings of cement have recently been placed on the market, the makers of which all claim that they will successfully withstand the action of the alkali in the cement. It is the action of the alkali in the cement which causes the destruction of an ordinary linseed oil paint, especially when applied to a new concrete surface. The waterproofing qualities of a number of these special cement coatings are in many cases greatly overdrawn. Therefore, in selecting a paint the purchaser will do well to test it for himself. The simplest way to do this is to procure a fairly porous brick and give it as many coats of paint as are intended to be given to the wall which is to be painted. (Two coats are always better than one, especially if a light color is to be used.)

After the coating on the test brick is thoroughly dry, have it weighed and make a note of the exact weight. Then put the brick in a pan or pail, in which there is just enough water to completely cover it. Allow it to remain submerged for at least twelve hours, and then remove it; after wiping off all of the surface water, again weigh it, and compare its weight with the weight before it was submerged. The difference in weight will show just how much water went through the coating and was absorbed by the brick.

Make a number of tests as described above with various paints, keeping careful notes of all results. The paint which shows the greatest water-resisting qualities will be the one to use. In making the above tests be sure to see that the bricks are thoroughly coated, and that plenty of time given for the paint to cure or harden before they are submerged in the water.

Aside from the colored coating mentioned above, there are a large number of so-called colorless waterproof coatings on the market. These are intended for use where one wishes to retain the natural color of the concrete. They are also largely used as a preservative for limestone, sandstone, etc. Probably one of the oldest materials used for this purpose is the ordinary commercial paraffin. This is applied to the surface hot with a brush. Then the surface thus treated is subjected to heat, which opens the pores in the stone or cement, and allows the paraffin to enter into all the small crevices and voids, thus sealing them up and preventing any further moisture from entering into the mass.—*Scientific American.*

Pigments Safe With Cement—For buff, yellow ochre; for light yellow, zinc yellow (zinc chromate); for red, red ochre or red oxide of iron: for blue, ultramarine blue (the sulphate ultramarine preferably); for green, ultramarine green or oxide of chromium green; for white, zinc oxide or zinc sulphide (lithopone); for black, mineral black, black oxide of manganese, black oxide of iron; for gray, graphite and lithopone, or lithopone and mineral black.

Waxing Cement Floors for Dancing.—Cement floors are as a rule too porous to be waxed successfully without being first filled. Though rather expensive,

shellac varnish is most convenient and best adapted for preparing the floors in the shortest possible time. Two thin coats of orange or brown gum shellac dissolved in denatured alcohol will give the proper foundation for the wax, which should be ordinary floor wax applied with a cloth or brush and polished with a weighted floor brush in the usual manner.

Flatting Over Fresh Cement.—Portland cement and sand three weeks old would be actively alkaline, and to treat such a surface with any hope of success the usual method of painting must be departed from. First of all, treat the surface with a solution of zinc sulphate (diluted to about half strength in water). Having allowed time for this treatment to become thoroughly dry, coat with paint, thinned only in turpentine, and bound sufficiently with varnish. For the second coat, use a similar mixture. The third coat should be thinned with three parts boiled linseed oil and one part turpentine. The flatting coat should be thinned out with turpentine, with the addition of varnish for the purpose of binding. A job of this nature might be successful.

"In painting, it is well to use considerably more turpentine than is ordinarily the case, and very little driers. In fact, boiled linseed oil is considered preferable to raw. For priming, the paint should be used thin, and contain so much turpentine that it is almost flat, increasing the amount of oil for succeeding coats. Each coat must be given ample time to dry before the next one is applied."—*Anon.*

Removing Paint Spots and Stains from Stone and Cement Pavements.—Make two solutions, as follows:

1. Place one-half pound of lime in a suitable vessel and slake the same with as little water as is required; then add one-half pound of caustic soda (98 per cent.) and one quart of water. Stir a while and let stand to cool down.

2. In another vessel slake one pound of quicklime with as little water as is necessary to make it fall into a powder. Then add one quart of water. Cover the vessel and let stand to cool down.

When the heat is well off, strain both solutions through a paint strainer, then mix the two, stirring well.

Now boil one-half pound wheat flour in one quart of water to a thick paste, but have no lumps in the same.

While still hot, under constant stirring, in order to prevent lumping, slowly pour the combined solutions, No. 1 and No. 2, into the paste, and when cool you will have a medium stiff paste, which will, when applied to the thickness of one-sixteenth of an inch, remove any oil or varnish paint in from thirty to forty-five minutes from wood, iron, cement or stone. When the paint is removed, the surface should be immediately washed with strong vinegar or acetic acid to destroy any caustic matter. If the wood is somewhat discolored it may be bleached with a strong solution of oxalic acid in water. Be careful when handling caustics. Also remember that oxalic acid is a poison. The caustic will destroy bristles. Use fiber brush.

Slake three pounds of quicklime (builders' lime is best) with enough boiling water to make it fall to pieces; cover the pot with a bag or piece of burlap to keep in the steam. In the meantime dissolve one pound of caustic soda or pearlash in enough hot water to effect a thorough solution and add it, while stirring,

to the slake lime. Do not make the paste too thin, but like a semi-paste paint, and apply over the spots with a fiber brush (not a hair brush). Leave it on for a few hours, then wash it off with warm water, and finally with clear water and mop. Protect your hands with rubber gloves.

STAINING AND PAINTING SHINGLES

REOSOTE THE BEST PRESERVATIVE.—It is generally conceded that the best preservative for wood of any kind is creosote, but how many of us can define what creosote really is? Roughly speaking, the creosote oil of commerce is what is known as "dead oil of coal tar." This coal tar creosote consists of all oils known as the "heavy oils," being residual oil, creosote, and pitch in solutions. This, "creosote" is what has been used for over a hundred years on railroad ties, etc. It is too crude a nature to be used "neat" in shingle stains, and many manufacturers simply thin it down with light oils such as benzine, etc. It is unnecessary to remark that benzine used in this way is "dope," which destroys the preservative qualities of the creosote. On the other hand, unless a large quantity of colorless thinner is used for this coal tar creosote, its color is so strong that it will "kill" almost any color used with it, causing a brown or black streakiness that spoils the appearance of a roof. Painters should always look with suspicion on any so-called "creosote" that has a benzine smell. It is proof that it has been adulterated to the point of making it nearly valueless as a preservative, otherwise the smell of the benzine could not be detected over the powerful tarry smells of the creosote.

There is another creosote called "wood creosote," which is largely used in the manufacture of shingle stains, and sold as "creosote" oil. It is a very light gravity oil of strong color and smell. The color is often given by the addition of "japan," and if the smell of this "japan" can be detected, reject it as being

of the "doped" variety. Any adulteration that produces evaporation destroys the preservative value of the "creosote."

The shingle stain should be transparent of color. It should not contain water. It should be free from poisonous matter, and there is no need of using poisonous pigment in its preparation.

Next to the preservative quality comes the subject of color. Mere preservative qualities without good appearance will not satisfy the public, and the two must be happily combined to give satisfaction.

The siennas, umber and oxides, easily adapt themselves to the making of stains with sufficient grinding, but the greens and reds require special attention. Experience has taught us that no greens but the high-priced "chemically pure" are of any use. It is ground with an asbestos float of light gravity, which prevents the pigment from settling. The colors are ground fine enough to float well throughout the mix, insuring good color-cover power, and rendering stirring practically unnecessary.

The reds, apart from the oxide red, is subject to the same treatment as the greens, and should be chemically pure color, or mineral color, not aniline, as aniline colors will not stand the sun.

How to Stain Shingles.—But it must be borne in mind that certain conditions must be observed in using these stains if the best results are to be obtained. The shingles should be perfectly dry before applying the stains. The shingles should be opened out of the bundle, and given time for drying. If it be necessary to thin the stain, use only raw linseed oil for outside, and turps for inside work. But it is seldom required, and if the stain is made too thin the color

is apt to fade out, and in any event will have a washed-out look. The stains are made of the right consistency for application and should need no thinning after leaving the factory. It has happened that the painter has extended the stain with kerosene, which is destructive to the stain. The stain will dry hard over metal, and when it does not you may suspect that kerosene oil has been put into it. The pure shingle stain contains more oil than paint does, and in consequence it needs plenty of air to make it dry when used inside. When used inside, the stain should stand at least 24 hours before being varnished over. The inside stains are not quite so permanent as the outside, being mixed largely with turps, but they will stand the direct sunlight for six years at least.

"In regards to painting shingle roofs, in this state where we have wet and dry seasons, I have had some repair jobs on cedar shingle roofs that have been painted. I find that at the end of each shingle the paint line is just a little higher than the shingle under, which has a tendency to hold the water that drains between the shingles, and as there is no way for the water to pass over this line, it therefore goes into the wood and stains can be seen on the under side of the shingle, unless the roof be very steep. Many of our architects specify stain, using the common creosote stain, but the shingles are dipped before laying, which gives the stain an even surface for more than two-thirds the length, and makes a lasting and perfect exposed surface. I have found old roofs, not painted, made of cedar shingles, that were perfectly sound and waterproof."—*National Builder.*

Artistic Coloring.—When staining a shingle roof use as few shades as possible, as this gives a more

pleasing effect than where several colors are used, and, if possible, do the entire job in one color. The greenish shades such as the olives, please the general public taste better than the other shades, probably because they harmonize more perfectly with nature. Avoid a reddish-brown or a pronounced yellow, or even a strongly yellowish-brown with a green roof. In fact, a greenish roof should be combined with a cool gray, and it cannot be effected by using Prussian blue. A beautiful effect may be gained by taking a pail of quite thin red and one of quite thin green, and with one brush put on the colors alternately, so as to give the varnishing effect of green and red, as seen upon autumn leaves. With this for the sides, a green roof may be used, the effect of the sides, at a distance, being grayish, and not red and green.

When a roof is to be painted or colored in any way, its use and location should be considered. A low roof, or roof of a low building, should be of a lighter color than that of a high and more imposing building. Light colors make a cooler roof, but they are more objectionable to the eye than darker colors, especially where sure to meet the eye frequently. The surroundings of a building are to be taken into consideration also. A rural dwelling that is surrounded by trees or shrubbery should have bright colors, such as red and ochre, which look very charming when viewed through the dark green leafage. The roof is a very salient part of a building's architectural features, and should receive artistic and skilful treatment. A badly painted roof may spoil the entire appearance of the best painted house.

The best way is to dip the shingles in the stain to a depth of about two-thirds their length, throwing them in a pile to dry. After they have been laid apply a

coat of the same stain with a paint brush, which will give a deeper and more uniform color, besides which it will color the parts that were cut to fit around dormers, etc. Stir the stain in the barrel often, and if you do not dip the shingles then give two brush coats on the roof.

The advantage of dipping is in the fact that all parts of the shingle are protected, and when the shingles warp apart, under the influence of the sun and wind, there will be no raw places to show through, and which unpainted parts detract very much from the appearance of a job of this kind. Dipping shingles will also keep them from warping.

CHEAP STAIN.—For a cheaper grade, the thinners may be made by mixing three gallons water white 150 degree test petroleum oil, three gallons creosote oil and one gallon liquid drier.

Crude oil, kerosene, benzine or other mineral oils also will not unite with the creosote, although such admixtures are frequently made by the painter.

Frequently shingles are painted. This should never be done, except they are dipped in their entirety to insure a full coating, which would prevent rain and moisture from being absorbed by the wood.

A painting of the shingles after they are laid is the most ruinous treatment they can receive, as the paint on the surface of the shingle will prevent the moisture from evaporating and will cause rot and decay.

An unpainted shingle will last better and longer than a painted one, as the moisture has a chance to evaporate within a reasonable time.—*George Whigelt.*

Creosote stains are not poisonous, as some painters imagine, but will heal sores, burns, etc., better than any

thing we know of. Water from creosoted roofs is unpleasant to the taste and should not be used for drinking purposes though the stains are mainly of non-poisonous pigments.

Creosote Stains.—Reject any alleged creosote stain that will not come up to the following test:

It should be somewhat heavier than water—1.030, water being 1.000. It should be a deep brown color, with probably a slight green tinge; it should distinctly smell of carbolic acid; it should give a clear brown spot when a few drops of it are run onto white blotting paper; if the center of the spot shows up black or very dark, reject the oil as fictitious or carelessly made. It should be free from crystals or deposit, and should show no thickening or crystallization at 40 deg., Fahr.

When using creosote stains and they should cause a burning sensation on the arms or hands, due to careless or much use, rub with linseed oil and wipe dry; do this frequently to prevent burning. Never wash off with water, as that will increase the discomfort by dissolving out the tar acids, of which true creosote contains about 10 per cent.

Creosote stains will become more or less thick in cold weather, owing to the more or less solid napthaline always found in creosote. In cold weather this may be remedied by keeping in a place above 40 degrees, and heating slightly when muddied by cold.

Not all pigments may be used with creosote, owing to the fact that creosote contains more or less sulphur compounds, in solution, and these by coming in contact with pigments containing metallic bases will very soon change the color to muddy or darker shades. The dark creosotes may be used for the dark colors, like

chrome green, gray, yellows, etc., use the refined creosote oil. This has been deprived of all or very nearly all of the sulphur compounds, making an oil that is very nearly inert to all pigments.

Painting Shingle Roofs.—Let it be of a good mineral pigment mixed with pure linseed oil only, with a little japan driers. Mix it quite thin—a mere priming coat—and the damming of the cracks will be greatly lessened, if not entirely avoided. It is best to use pigments that are ground in oil, for the dry pigment is too coarse for this purpose. Nor should a ready mixed paint be used, for it will likely be unfitted for this particular purpose. After mixing the paint, strain it through a fine sieve, which will remove any foreign particles and make the mass more perfectly incorporated. To mix it, add a little oil to the pigment at first, and work it into a smooth paste, gradually adding more oil until the mass is quite soft, and then it may be further thinned for application. The use of driers should be carefully done, as excess of this liquid will tend to injure the paint, so that it will not wear as well. Paint on shingles is on a position to suffer a great deal more from the weather and sun than where used on the sides of houses. Therefore, see that it is of the best quality and carefully mixed. Many times it will not require any driers, as in summer, in dry weather.

Shingles may be dipped in paint just as with single stain, by making the paint very thin, and adding some benzine to the mixture, which will thin out the paint and make it more penetrative, while not affecting the paint, as it evaporates and leaves the oil as it was. Place the thin paint in a tub or half barrel, and tack a strip across, and as you dip the shingle draw it against the strip, which will remove the excess of paint.

The pigments used for the shingle painting should be not only very finely ground, but transparent also. Such colors as raw and burnt sienna, raw and burnt umber, chrome green, chrome yellow, Prussian blue and drop black are useful pigments. These colors may be used alone, or in compounds, according to the colors you wish. Thus umber makes a walnut shade, as also does Vandyke brown, only darker; raw sienna makes an oak color; burnt sienna makes a cherry color; a light pigment may be toned down with black or umber or Vandyke brown; Vandyke brown may be imitated by mixing together burnt umber and black. Raw sienna and a little burnt umber will give a dark oak color. Chrome yellow will lighten up chrome green, and black will tone it down. Zinc white will be used when a white is desired, because it is non-poisonous, a matter to be considered when the water is to be used for culinary purposes; sometimes the water from the roof is caught in a cistern and used. In such a case do not use any of the lead color, such as chrome yellow, chrome green or white lead. Vandyke brown and also drop, ivory and lamp black, are perfectly safe colors to use.

Colors may be blended on the roof after painting by applying two or more colors in bands like, and softly blending them with the brush. This makes some very pretty effects, and takes very little more time. For this purpose use the paint slightly thicker.

PAINTING WITH RED LEAD

THE difference between red and white lead may be simply stated by saying that white lead is pure lead plus carbonic acid gas, and red lead is pure lead plus oxygen. Both forms of lead are made from the metal lead, and when the gases which combined them to form red or white lead are driven off by heat, they resume the pure metallic form again. By a special method of heating the lead, melting it and allowing air to pass freely over it, there is first obtained litharge, PbO. Further heating produces red lead or orange mineral, Pb_3O_4. This orange mineral is very similar to red lead and ought to answer as well for painting, but does not.

There are many kinds of red lead on the market, and nearly all are pure lead pigments, but their value as painting materials varies greatly within wide limits. Chemically, red lead is a mixture of litharge and red lead. It is the litharge that causes the mixed red lead paint to set so hard in the pot or keg after being mixed with oil and allowed to stand for some time. Broadly speaking, the more litharge a red lead contains the heavier it is, the less covering power it has, pound for pound, and the more it tends to settle or become hard after mixing. Government specifications call for a red lead containing at least 94 per cent. red lead, and this is true also of many of the largest railway companies. This insures the minimum amount of litharge and the maximum bulkiness and fineness. They also specify that the red lead must be mixed on the spot, when wanted for use, in pure,

raw, well settled linseed oil, and without driers. Such a paint will dry by oxidation on the surface to which it is applied, in a cement-like film, that admits of no pores through which moisture may infiltrate. First they see that the surface to which the paint is to be applied is made perfectly free from scale, and clean.

A ready mixed red lead paint cannot be a pure paint, for the reason that it would become too hard in the container to be useful. Hence such paint is mixed with such substances as China clay, silica, or similar inert materials, which tend to prevent hardening. Whiting and barytes also are used in this way, but such compounds have no more value than iron oxide paint, which merely affords a loose, porous film, quite unlike a red lead paint film. Some of the ready mixed red leads contain soap, paraffin, wax, asbestine or graphite, which keep the red lead in suspension. The only way to do in order to have a perfect coating is to mix the dry red lead and oil on the operation, day by day.

Excepting in special cases, and which are given in this connection, no driers should be added to red lead paint, for it will dry easily with raw linseed oil. Driers decompose the oil.

A peculiarity of red lead paint is that it will assist in drying the paint coating over it. If you prime or first-coat with red lead and place a white lead coat above it, the latter will be assisted in drying by the influence of the red lead beneath it. Hence very little, if any driers need be added to the latter coating.

After drying, red lead paint remains elastic, a very important feature, particularly as regards metal, for it allows of expansion and contraction without allowing the paint to crack in any degree. It also hardens without shriveling, even where applied in

heavy coats, and forms the toughest and most perfect insoluble combination of all forms of protective paints. It imparts no oxygen to iron, even when exposed constantly to dampness.

Red lead should be very finely ground, for then it has less tendency to settle in the pot. Some red leads are coarse and crystalline, and so unfitted for paint. Examine under a microscope and compare with a standard good grade. If the red lead is pure and very fine, it is just as good when mixed dry with oil as it could possibly be with grinding in oil. Mix only what is required for immediate or daily use.

It is advised by some to mix up red lead for next day's use by adding about three-quarters of the oil necessary to its proper mixing, forming a stiff paste, which will give a more perfect admixture of pigment and oil. Next morning, when ready to use it, add the balance of the oil to form a suitable paint, stirring in the oil thoroughly and keeping the mix well stirred in the pot while using. Clean out the paint pot at quitting time, allowing none of the paint to remain, as it would become like cement in the pot if left there. If not kept continually stirred while in use the oil will, by settling to the top, be used up first, and the work will show less and less of the lead until the oil is used up. Mix thin, and brush it out well; allow one coat to become perfectly dry before applying the next coat.

A satisfactory thinning of red lead paint may be had by mixing at the rate of 33 pounds of the lead to one gallon of raw oil and one quart of turpentine, and if not thin enough add a little more oil. As a rule turpentine should not be used with red lead, but is sometimes used when the weather is damp or

very cold, as it then facilitates the spreading of the paint.

While plenty of oil is advised in mixing red lead, the rule has some exceptions. If we can get heavy red lead paint on, rubbing it out well and having the least amount of oil in it, it will be more wear resisting than a very oily red lead paint. But painters object to the difficulty of spreading heavy red lead paint, and for this reason they will thin it out too much. This causes the paint to sag or run. Dried, uncombined linseed oil, whether raw or boiled, is an absorbent of water, and hence the more red lead and the less oil the better it will protect metal.

Raw oil may be used in summer, and boiled oil in winter.

The use of dry red lead is one of the very few exceptions to the rule that a dry pigment mixed with boiled oil should never be used as a primer.

It is held by some that red lead paint mixed with raw oil will not harden without the assistance of some driers, and when applied to iron will not prevent rusting. This is true where the oil contains some non-drying or non-saponifying oils, as adulterants, or if the red lead is adulterated with iron ore or red stained barytes (neutral), since these pigments cannot assist in the drying of the oil. But it is well known that no paint hardened by driers can be waterproof. The drier, being a liquid, unites with the oil acids before the slower acting dry basic pigment can combine with it, leaving behind the neutral fats of the linseed oil, which have little or no chemical affinity for basic pigments, and the paint remains a conveyor of water, and so the iron is attacked and destroyed by rust.

It is generally the custom to use boiled oil with red lead, for painting iron structural work, but this is a mistake, for the reason that boiled oil being neutral does not saponify sufficiently to prevent free red lead and uncombined oil in the paint, and the result of this is that the free oil must oxidize by absorption from the air; this oxidized oil finally becomes brittle and perishes. Paint thus prepared is not waterproof, and hence cannot protect the iron.

Red lead is especially valuable for painting wrought iron. Cast iron is rough and will hold any sort of paint, but the wrought iron is smooth and needs a tough, elastic paint which will hold of itself, no matter what the condition of things beneath it. This, red lead paint does; but care must be taken not to make the coating too thick or heavy, especially when boiled oil is used, as this would cause wrinkling, besides making a surface that would likely crack superincumbent coats of paint.

Preventing Settling.—There are ways to prevent the settling of red lead in the pot, and while the materials employed for this purpose injure the protective qualities of the paint more or less, yet in some cases it will not be found very objectionable. Thus, by mixing the dry red lead to a pulp with water, then adding the oil, stirring it in vigorously to incorporate it with the water and lead, the lead will hang in the oil for hours without settling. The water will then dry out after the paint has been applied, and possibly leaving the lead and oil more intimately mixed than it would have been without the water.

Another way is to add whiting, which will also prevent sagging. Sagging is a fault of red lead that is too heavy, and on a very close or hard surface. The

whiting does not seem to affect the wearing of the paint appreciably, but of course too much of it must not be used. It does not alter the color of the paint unless used in excess. You may add as much as one-half or even three-fourths whiting. It makes the paint work easier, holds it in suspension, prevents sagging, and some say it adds to the elasticity of the coating, though this may well be doubted. Such a paint will adhere to metal well, and its color may be modified with lampblack.

The addition of lampblack seems to improve red lead paint, not only in giving it a more agreeable color, but by making it more elastic and durable, and some think it keeps the lead in suspension to some extent. The addition of one-sixteenth of an ounce of lampblack to the pound of red lead will give a pleasing chocolate brown. It is not advised to add more lampblack than this if the best results are desired with the paint. And when lampblack is used with red lead there should be a larger proportion of oil than when the red lead is mixed alone in oil, as lampblack takes up more oil than red lead does.

The iron surface that is to be painted should be made clean by scraping and dusting off, and the first coat may be mixed from dry red lead and raw oil three-fourths, and turpentine one-fourth, or turpentine may be omitted and oil increased to that amount. The second coat may contain some turpentine, but the third and last coat should consist only of raw linseed oil. A job done in this way will retain a bright surface for a long time.

To ascertain the cost of a red lead paint made according to the formula I have given, estimate the 33 pounds of red lead, dry, as seven-sixteenths of a gallon increase over the amount of liquid used in thin-

ning the red lead. One gallon of this paint will cover approximately 800 square feet of plain painting on average metal surface.

The following will show the results obtained when different proportions of lampblack are used:

20 lbs. red lead 5½ lbs. raw oil 1¼ oz. lampblack	1 gal. of paint and covers 1200 sq. ft. ratio, 1/16 oz. lampblack to lb. red lead.
14 lbs. red lead 6 lbs. raw oil 7 oz. lampblack	1. gal. of paint and covers 1200 sq. ft. ratio, ¼ oz. lampblack to lb. red lead.
10 lbs. red lead 6¼ lbs. raw oil 10 oz. lampblack	1. gal. of paint and covers 1620 sq. ft. ratio, 1 oz. lampblack to lb. red lead.

In blendings of lampblack and red lead the use of boiled or raw oil with japan is desirable. Says the president of one of the best-known lead oxidizing companies:

"Red lead and lampblack dry very slowly in raw oil, less slowly than when japan is introduced, and in boiled oil dry more quickly, the drying property varying with the quantity of lampblack used—the more lampblack the more slowly the paint dries. So in a mixture of red lead, lampblack, raw oil and japan or boiled oil the amount of japan necessary will vary with the amount of lampblack used. We wish to say, however, that japan or boiled oil are employed not so much for their drying properties as they are for the purpose of a binder to prevent the red lead, lampblack and oil separating from each other, which is occasioned on account of the red lead being so much heavier."

In about the proportions of the preceding tables, "mixtures of red lead, lampblack and raw oil dried in

from 16 to 24 hours, the mixture containing the most lampblack being the longest in drying. Red lead, raw oil, lampblack and boiled oil, about 12 hours." These results will vary with the weather, etc.

Red Lead Paint Formulas.—1. To 100 pounds dry red lead add four to five gallons of raw linseed oil, one quart of turpentine japan, and one quart of good varnish.

2. To 100 pounds of dry red lead add four gallons of raw linseed oil, one quart of turpentine, one-half pint of japan for slow work, and one pint of japan for quick work. This formula is used in a Baltimore shipyard.

3. To 100 pounds of dry red lead add four gallons of raw oil, for summer, and boiled oil for winter, one gallon of turpentine and one-half gallon of japan. This is the formula used by the Pennsylvania Railroad Company.

4. To make a paint, one railway company adds 10 ounces of lampblack to 12 pounds of red lead, mixing this with sufficient raw linseed oil to make one gallon of paint.

5. The first formula given is from Messrs. Booth, Garrett and Blair, chemists, of Philadelphia, and here is the process for making the paint: For the first coat use 11 pounds of red lead to one quart of oil. Let this thick mixture stand a short time, then thin it with a mixture of one pint of raw oil and one-quarter pint of japan. This will make one-half gallon of mixed paint. For the second coat take 10 pounds of red lead, three ounces of lampblack, and one quart of oil. Thin this with one pint of oil and one-quarter pint of japan.

6. Red lead paint may be made by thinning 25 pounds of dry red lead with one gallon of raw lin-

seed oil, mixing thoroughly, and straining. To hasten drying add a gill of good driers. This will make a gallon and one-half of paint, and ordinarily will cover 700 square feet, one coat, of iron surface.

7. A certain railroad company uses 21 pounds of red lead to a gallon of oil. A New York bridge company specifies the ratio of three and one-half of red lead to one of linseed oil by weight. The Pennsylvania Railroad Station, at Broad Street, Philadelphia, took 20 pounds of red lead to the gallon.

NON-HARDENING PAINT FORMULA:

65 lbs. dry red lead.
10 lbs. dry silica.
10 lbs. dry China clay.
1 lb. drier
1 lb. turpentine substitute.
20 lbs. linseed oil, raw.

Red lead is permanent except in presence of sulphur or sulphides.

COMPARATIVE COST OF RED LEAD AND OXIDE OF IRON PAINT.—A pigment that gives a very satisfactory reddish brown and contains about 40 per cent. of iron oxide makes a satisfactory paint containing approximately 56 per cent. pigment and 44 per cent. vehicle, the vehicle being very much the same as that used in a first-class white paint. Such a paint will weigh about 13.5 pounds to the gallon, which, therefore, will contain 7.56 pounds of pigment and 5.94 pounds of the vehicle. This pigment is cheap, generally costing not more than one or one and one-half cents per pound. The pigment in a gallon of this paint, therefore, would cost approximately 10 cents,

and the 5.94 pounds of vehicle about 73 cents, giving a cost of 83 cents for the gallon of paint.

An inspection of these figures shows that the expensive part of this paint is the vehicle and not the pigment. A paint of this character is a very good material to apply either to wood or iron. There are more expensive paints, however, frequently used on iron to protect it from rusting, the most popular being red lead and linseed oil. This material undoubtedly affords very good protection, but it is also expensive. A red-lead paint cannot be made and kept as other paints can. The red lead itself causes the oil to dry, and no additional drier is necessary. In fact, red lead should not be mixed until just before it is used. A paint made of 70 per cent. of red lead and 30 per cent. of linseed oil will weigh about 19.8 pounds to the gallon. A gallon of paint, therefore, will contain 13.86 pounds of red lead, which costs about eight cents a pound, making the cost of the pigment in a gallon of this paint approximately $1.11. The 30 per cent. of linseed oil will weigh 5.94 pounds, and a gallon of linseed oil 7.75 pounds, costing about 90 cents at the present time, or 11.5 cents a pound. The oil in the paint will cost then about 68 cents, and a gallon of red-lead paint would cost $1.79, as compared with 83 cents for a gallon of oxide of iron paint. These two paints will cover about the same area of clean iron, and while somewhat better service might be expected from the red-lead paint, it is more than twice as expensive as the iron-oxide products.

PAINTING TIN ROOFS

IN PLATE in sheet form is not the same as in its pure state as an ore. As a metal pure and simple, it is of a brittle, crystalline nature. It belongs to a class of soft metals, but not like lead or copper, sufficiently soft and malleable to be of practical value in sheet form without being alloyed with some other metal. To be of practical value as a sheet metal, it must be united to a harder and tougher metal; This harder and tougher metal to be the body of the plate, and of a texture not too fine a grain, but sufficiently porous, so that the applied coating or plating of tin will penetrate beneath the surface and form a covering for the same, that will be lasting and not wash off by rains or weather exposure.

In these later years, since there has been so much agitation unfavorably and otherwise, over the subject of the quality of the tin now in use for roofing, manufacturers have been led to stamp on each sheet the brand and quality of the tin. The thickness of tin plate is designated thus; IC for the lightest grade; IX, one cross, the next heavier; IXX, two crosses, still heavier, and so on up until the highest grade, IXXXXXXX, seven crosses, is reached. The heavier grades above IXXXX are not in general use.

There are two classes of tin plate, termed bright tin and terne plate. The former is used mostly for all work except for roofing purposes. The latter, terne plate, is used almost wholly for roofing purposes and in most, if not in all cases, where the metal is

subjected to outside weather exposure and climatic conditions. Before the introduction of terne plate, bright tin was used for roofing, as well as in all departments of the sheet metal industry, but for roofing purposes terne plate is considered better, as it is presumed to stand all kinds of atmospheric action upon it better than the bright tin. This is owing to the fact that the alloy with which it is coated or plated is composed of lead and tin, in the proportion of two-thirds lead to one-third pure tin.

The difference between a good and a poor quality of tin plate lies in the nature and character of its plated surface and in the fibral texture of the body plate which forms its base. But more largely in the latter, the fibral texture of its base, than in the composition of its outer surface, when considering its durability. The best quality of tin plate, both the bright tin and the terne or roofing plate, shows a bright surface on each side of the plate, free from specks or streaks. The bright tin plated wholly with pure tin has a bright polish of silvery hue. The terne plate coating, being two-thirds lead and one-third tin, presents more of a leaden hue, both sides of the sheet being covered with a smooth, mottled surface. The body of the plate of the metal is soft and pliable, and of the best grade, free from pinholes or blemish of any kind, and sufficiently tough in its fibral texture to be worked into locked seams without cracking the body plate or its outside coating.

It is a well-known fact that prior to 1875 there was no such thing known as a steel base for tin plate in general use.

It is also an equally known fact that tin roofs began to deteriorate in value on the introduction of Bessemer steel base since that time.

Upon the cause of this deterioration, Mr. W. S. Goddard had this to say before the tin plate conference: "That while the cause of this trouble is a question as yet unsolved, we know that it does exist and no remedy has yet been found. It is known to be what is called an internal corrosion, or disintegration of the steel base between the coatings. When this occurs the coating disappears and you have a pinhole or rust spot; for it is a well-known fact that the coating will not adhere to rust or when the surface is not perfectly clean.

Rust, or the hydrated oxide of iron, once established, contains all the elements of a long and ceaseless life, and as long as it is in contact with a ferric body its activity never ceases. It is to a terne plate what a cancer is to the human body. Rust begets rust. It may be held in check for a time, but when the efficacy of the material used to check it is exhausted, then the rust again commences its inroads. There is only one cure, and that is to eliminate every trace of rust."

So we can see the senselessness of the claim put forth by many, that a tin roof should be allowed to rust before being painted. Those who advocate this, simply start the rust on the way and defeat just what the mixture of lead and tin is applied to the plate for, namely, to preserve it from rust.

It is a well-known fact that all the old reliable brands of tin made their enviable reputations as a roofing material on the fact that the base of the metal was charcoal iron. Examples of which in this country and in Canada, to say nothing of its use in England and other countries, show that these roofs have stood the test of seventy-five years or more.

Now, in considering the relative value of iron and steel as a body for sheet tin, the question arises, wherein lies the difference between them. The surface covering or plating in both cases are the same, and all other things being equal, their lasting qualities are the same. So, if one is better than the other for roofing purposes, we must look for the cause of it not in the character of the surface covering, but in the character of the metal which forms its base. The test in this matter is the comparative ability of the two metals to withstand weather exposure under all kinds of climatic conditions.

New tin is covered with palm oil, and as paint will not adhere to palm oil, this oil should be removed before painting. There are two ways to do this. The right way is to scrape off the rosin and take cotton waste and benzine and wash off the palm oil. This should be done immediately after the roof has been put on. Benzine cuts the grease, cleans the tin and leaves it bright and ready for immediate painting. The benzine costs but little, and when this method is adopted the life of the roof will be more than doubled.

The other way to get rid of the palm oil, and the way most generally adopted, because it is cheaper, is to let the roof remain unpainted until the rain has washed the palm oil off; but in the meantime the tin has become rusty. In the end this is the more expensive way, for unless the rust is thoroughly cleaned from the tin, it will go on eating even under a coat of paint, and shorten the life of the roof.

"I well remember the first tin roof I ever painted. It looked easy enough, and I applied the paint in the usual way, and was much surprised when it did not stick.

"This set me to thinking, and I took particular occasion to study the next tin roof I had to paint, and discovered that the tinner had left many traces of rosin, the tin was also very greasy in many places, and I did not wonder that the paint on the first job didn't stick.

"I experimented with different solutions, and found the best way to go about it was to scrape off all the rosin first and go over every seam with kerosene, then wash the roof off with good, clean water.

"When a roof is greasy, wash it with a solution of sal soda water, about three-fourths of a pound to five quarts of water, let it stand for a few hours until thoroughly dried, and this will do the trick."—*Correspondent.*

The roof should be carefully cleaned of all rosin spots, dirt, etc., and should be bone-dry before the paint is applied. Keep workmen off the roof as much as possible at all times, before and after painting.

After the roof has been cleaned with benzine a coat of paint should be immediately applied. In all cases the paint should be well brushed out, as a thin coat is better than a thick one, because it is more elastic and more readily contracts and expands with the tin.

Regarding painting an old tin roof, first let the tinner repair any possible damages. In case this is not done, or cannot conveniently be done, then scrape and clean the tin, and where a leak is found or suspected, take a strip of linen toweling and dip it in the paint, and lay it smoothly on the broken part. Then paint the roof with a good paint, iron oxide or graphite, as desired. Linen material is advised in this method, for the reason that cotton will rot from the action of the oil, while linen will not.

The working specifications adopted by the National Association of Master Sheet Metal Workers require the initial painting to be carried out as follows: We quote verbatim:

"Painting: Before laying, the tin to be painted one coat on the under side. The upper surface of the tin roof to be carefully cleaned of all rosin, dirt, etc., and immediately painted. Paint to be of pure metallic brown, iron oxide, or Venetian red as pigment, mixed with pure linseed oil. No patent drier or turpentine to be used. All coats of paint to be applied with a hand-brush and well rubbed on. Apply a second coat two weeks after the first. The third coat to be applied one year later."

Asphaltum is injurious to tin roofing, and it is advised never to use any paint on a tin roof that contains tar, pitch, or bituminous compounds. This point has been tested by the Association of Sheet Metal Workers.

In mixing roofing paint it is better to use raw linseed oil than the boiled oil.

A writer says he knows of nothing better than red lead ground in raw, cold-pressed linseed oil, applied the day it is mixed, which is a wise precaution, for red lead settles in the pot quickly, and should be used dry, and be mixed just before beginning the job; if ground in oil, as the writer describes it, it would be hard and difficult to mix. For this reason red lead is very seldom bought ready ground or mixed. He states that after painting a roof with the red lead he applied iron oxide paint, being persuaded to do so, he adds, with the result that the brown paint peeled, and even the red lead paint came off in places. Doubtless the brown paint failed to hold on the hard surface of the red lead paint. I would not advise the red

lead priming coat. There can be no advantage gained over the use of a simple iron paint.

Paint with short handled brushes, rubbing the paint well in. Do not spread paint out too thin. Never use long-handled brushes or mops to apply the paint. Paint new tin roofs at once. A good rule is to apply the paint before the sun goes down on the work. If extra-heavily coated hand-made roofing tin is used, the roof can safely go for several days without paint, but it is just as well to apply the paint at once.

A tin roof is often damaged slightly by scratches caused by workmen walking upon it. The paint prevents rust from starting at these points. The paint should be applied before the slightest trace of rust appears. It is sheer folly to allow a good tin roof to stand until it rusts slightly before applying the paint, as some ignorant roofers do. No paint will stop rust after it has secured a foothold. The roofer who allows the roof to rust, even slightly, before he paints it, invites trouble, as the rust will continue its action under the paint, and destroy the roof.

The tin should also be painted one coat on the under side before the sheets are laid on the roof. Some good roofers advocate two coats for the best class of work. This painting protects the tin from the effects of moisture condensing on the under side.

A new tin roof should be painted as soon as it is laid, with one coat of approved paint. Two weeks later it should have a second coat, both coats well brushed out. Two thin coats are far better than one heavy coat.

One year later the roof should have another coat of paint.

After that, painting at three or four-year intervals should be amply sufficient to repair the natural wear and tear of the weather. The interval between paintings can be lengthened as the roof ages and the paint-skin thickens.

The approved paints are red lead, red oxide, metallic brown or Venetian red, mixed with pure linseed oil. Very little if any drier should be used.

A very intelligent painter writes to the *Scientific American* that he "knows of nothing better than red lead ground in raw cold-pressed linseed oil, applied the same day it is mixed." He painted a roof eighteen years ago with two coats of red lead, and every three or four years since (through persuasion, he adds), he has given it a coat of iron-ore paint. He says there is "little or no flaking of the red lead," but "no end of trouble from the iron-ore paint, which in some places peels off from the red lead in large patches." He leaves us to infer that there is some flaking of the red lead. There should be none at all. And that the iron oxide paint came off was due, doubtless, to the inability of the iron paint to find a "hold" on the smooth, hard surface of the lead.

To get the best results, about equal weights of pigment and oil should be used. We therefore recommend the proportion of seven and one-half pounds dry paint to each gallon of linseed oil.

The dry pigment should first be put in a suitable vessel, the oil poured on top and then left for several hours—if possible—before they are stirred up. Stir thoroughly until you get a smooth, uniform mixture.

To thin the paint when it is ground in paste form, two and one-half gallons of linseed oil to each 25 pound can of paste.

We do not recommend the use of driers except

in cold weather, when from five per cent. to ten per cent. of the best japan drier may be used, depending on conditions.

The paint should be applied evenly, of medium consistency, and well brushed out. Choose a good, bright day, if possible, and apply the paint in the morning. There will be no need of driers to the color if the metallic paint is used. The graphite paints require driers, unless it has been added to the paint in paste form.

In mixing preservative coatings for tin roofs the matter is seldom given the attention it deserves. Any old odds and ends of color, without regard to whether it is composed of a lead or zinc base, is often considered suitable for painting a tin roof. This is a mistake, as any tough or hard-drying pigment will scale from a tin roof when the elasticity of the oil has departed. This fact may easily be demonstrated by tests. Paint strips of the tin with lead or zinc paint, and use mineral colors or graphite on the other portions, and note the difference in the wearing qualities.

Some of the oldest and most expert painters prefer Venetian red paint for tin roofs. There are at least two kinds, one a pure iron oxide, and the other of a bright color. The English Venetian red is generally supposed to be the best of the class. Red lead may answer, but it is costlier than the browns, and harder to mix and apply. In the thinning of red lead paint some advise linseed oil and turpentine in equal parts, while others use two-thirds turpentine. This is claimed to form a hard and durable cement.

Never place tarred paper under tin roofing. It will surely corrode the tin. Sheathing paper is all right.

Whatever kind of paint you may use, see to it that

the tin is perfectly dry before painting, and if the work can be done in the early fall, in dry weather, it will need no driers in the paint, and the work will last much longer than when done in warm or hot weather. The best work can be done with a round paint brush, not with a wide brush fixed to a pole. Get down to it, rub the paint in and brush it out evenly. Avoid runs along the seams, as a run or excess of oil in any place will eventually cause the paint to peel off. Be sure that every part is perfectly coated.

An inexpensive paint may be made for old gutters, etc., by the following method: Place all the old paint skins, the cleanings from paint pots, bits of dry putty, and any old paint on hand, into an iron kettle with some raw linseed oil, and boil the mass until all is dissolved. Then strain, and add fine dry sand until the mixture is about like the average paint consistency, so that it will spread well under the brush. It is best applied hot, or at least warm, and a quite heavy coat should be given. It can be used around flashings, chimneys, etc. When dry it has a hard, enamel-like surface, and it may be colored to suit any surrounding color. If it has been properly prepared it will be as smooth as glass.

Tin roofs are known to have stood as many as eight years without repainting, after being done with brown paint. But it must be remembered that a roof may seem to be in good shape as regards the painting, and yet not be. Here is where some make a mistake and rush into print with it. The roof ought to be carefully examined, in various parts of the surface, and its true condition noted.

PAINTING AND BRONZING RADIATORS

THE radiators for steam and hot water heating apparatus require to be lacquered with varnishes of special quality, owing to the high temperature to which they are exposed (nearly the boiling point of water). Oil paints are unsuitable, being too liable to blister, whilst colors turn brown and peel off. The best lacquer is a good asphalt varnish, which, when baked, will keep its gloss and last a long time; but black is not a favorite for this purpose. The same material can, however, be used in the preparation of red-brown, dark brown, and gray shades, by adding Venetian red and lithophone respectively to the asphalt varnish.

To obtain a durable coating of all paint topped with varnish, the former must be well thinned with turps, so that it dries matt, another coating then being given and varnished with special varnish. Some commercial varnishes sold for this purpose soften under the influence of heat, and in a very short time become brittle and rub off under the finger. The varnishes should be made of copal, inferior grades being prepared from hardened resin or colophony, and should be thinned in order that they may harden quickly and not turn brown. Thicker varnish can only be used when a baking oven is employed, the coating then being very durable, and of good appearance.

PAINTING RADIATOR WHITE.—It is difficult to get a white job that will remain white, for the paint will

be more or less affected. It is found best to use what is called a white varnish, or very light copal made of hard gum to withstand the heat. Make the preparatory coats white and flat, sandpaper smooth, or at least rub off any roughness you can, then apply the white enamel varnish. Use red seal French zinc white with turpentine for the flat coats, and then two coats of white copal varnish. Lithopone is said to do well on white radiators.

The factory formula as given by Scott, is as follows:

Common zinc oxide.....	22 lbs.
Barytes	10 lbs.
Pulverized soapstone	3 lbs.
Grind in	
Japan gold size.....	½ gal.
Turpentine	¼ gal.
Carbon tetrachloride	¼ gal.

This paint dries very flat, and is not much discolored by heat. If preferred it may be ground in the celluloid mixture, in which case there will be no discoloration whatever. This solution is made as follows:

Four ounces soluble gun-cotton, dissolve in 32 fluid ounces amyl acetate. Let stand ten hours, then add 32 fluid ounces amyl acetate. Finally add the following solution: 1 ounce gum camphor, dissolved in 8 fluid ounces acetone.

This solution must be thinned with amyl acetate, when thinning is necessary, as benzine or turpentine will cause the gun-cotton to precipitate its original cotton. Try to get in touch with a dealer who handles such paint as radiator white.

Oil paint will not answer for radiators. Use instead a color ground in japan, thin with good bak-

ing varnish, and do not make the paint too heavy or thick.

Painting Radiators.—Clean all greasy spots with benzine. When the iron is clean take any good bronzing liquid and stir enough aluminum into it to make a paint that can be easily spread with a camel's hair brush. Apply one or more coats, as the case may require. If you prefer to make your own bronzing liquid take equal parts of gold size japan and light-colored baking varnish and mix them well. To each liquid ounce of this mixture add three liquid ounces of turps. Shake well in a bottle and it is ready for use. If the aluminum paint doesn't give you sufficient lustre, apply a coat of baking varnish to your radiators, and when it gets tacky dust the dry bronze on with a camel's hair brush or tuft of cotton, spreading a large sheet of paper on the floor under the radiator to catch the surplus bronze, which can be used again.

Black Radiator Varnish.—(1) Prime Syrian asphaltum or Gilsonite, 10 parts, are heated over a moderate fire with 2 parts of linseed varnish until uniformly fluid, and the mixture is thinned down to the consistency of varnish with turps when cool. (2) Asphaltum, 6 parts; Lignite asphaltum, 4 parts; and linseed varnish, 2 parts are melted together, and thinned down, when cold, with turps and benzol or heavy benzine.

Bronzing Steam Pipes and Radiators.—For gold bronze powder paint the pipes with medium chrome yellow, and when this has become nearly dry rub on the gold bronze, using a piece of fur or a brush. When perfectly dry apply a coat of thin copal or mastic varnish.

Oxidizing a Radiator.—Paint the radiator a dull yellow, and when dry lightly sandpaper smooth, then apply a thin coat of color, a mere glaze, and of whatever color you may fancy, and rub out to simulate the oxidizing.

Painting the Logs of Gas Radiators in Imitation of Wood.—These logs are usually bronzed with copper bronze or green bronze, and then blended in with colors, so as to imitate the bark of certain trees. To give certain effects, such as the bark of birch or maple shows, asbestos fiber is attached in certain spots.

The colors used, or rather, the pigments employed, must be resistent to heat, as, for instance, umber, raw or burnt. Indian red, mineral brown, oxide of chromium green or copper green. The paint must be made with a medium or binder of silicate of soda, because there is no medium containing oil or gums will be able to stand such degrees of temperature as are required here.

Bronzing Solution.—Reduce a good varnish with turpentine to the condition of a bronzing size, being careful not to get it too thin, coat the surface with this and dust aluminum bronze on; this is the best way. To mix the bronze with the size, to be painted on, use equal parts of varnish and thinners.

PAINTING STRUCTURAL IRON

FOR years the practice of giving structural steel one coat of protective paint before it left the shop held universal sway. Of late, however, the custom has been questioned, many architects and engineers having the steel delivered unpainted. The new idea has much to recommend it—two considerations, especially. The first is that a certain amount of weathering is desirable to get rid of mill scale. The other is that shop coats are generally poorly done by cheap labor and really do more harm than good, because they cover up the evidence of poor work in the matter of cleaning the metal. In case there is no shop coat, the first painting should be done just before assembling begins.

PAINTING ON IRON.—Whatever may be said respecting the application of paint to the surface of iron, certain it is that once rusting begins, nothing in the way of paint will arrest disintegration of the iron thus begun, or prove durable upon such a surface. Attention has been called to the fact that the marks made by iron workers upon structural iron, to designate the dimensions of the pieces, and which is usually thought to be made with a lead and oil, or turpentine paint, never reveal rust beneath them, after the entire surface has been subsequently painted, though rust has been found under all the coating but those of the aforesaid marks. The car painter attributes this to the fact that the marks were made

while the iron was hot, or at least warm. Of course, we know that this is not so. The marking is done while the iron is cool, at least usually so. There is no doubt that much of the preservation from rust is due to painting the marks soon after the iron is made, and before rust has begun. Iron that is intended for outside exposure, at least, ought to be coated with paint as soon as possible after leaving the hands of the iron workers.

Painting Iron Bridges for Railroads.—All the iron ore paints contain phosphorus and sulphur, unless the ore has been burned to eliminate those properties; and either sulphur or phosphorus is inimical to iron. Asphaltum paints are usually well supplied with benzine or some other volatile product, which soon evaporates after it has been spread upon the iron, and leaves a rough surface upon which soot and sulphur from the burning coal in the locomotives accumulate, and with setting of fog and dew upon the iron, produces an acid which, by contact with the iron, causes oxidation on the surface of the metal, which causes serious injury to the structure, and very soon requires a thorough cleaning and repainting. Many of the cheaper paints are of a thick, syrupy nature, and require a large mixture of naphtha, benzine or turpentine to make them spread readily. These paints are of short duration, and require such frequent renewals that they become expensive.

I think, on the whole, that pure linseed oil and lead, properly put on, and colored so as not to draw or absorb from the sun's rays, make the most lasting paint, and give the best protection to the iron. In my judgment, all iron in bridges should be coated with boiled linseed oil. In warm weather this can

readily be put on so as to cover the inequalities of surface; and when two or more places are to be riveted together, each surface should receive a coat of paint carefully applied in the shops where the work is being done. Then, when the structure is erected, it should receive two coats of lead and oil paint of some light gray or stone color. And before painting, all places where rust has taken place should be thoroughly cleaned before painting. Experience shows that bridges cared for in this manner have given better results and are really more economical in time than those painted with other than lead and oil paints.—*G. M. Reil.*

Painting Structural Iron Work.—The surface must be vigorously cleaned, and should be painted while rust free and while it is warmer than the surrounding air—to prevent, so far as possible, a layer of moisture between the paint films and the steel. No paint put on over rust will prevent further rust, because rust is an accelerator of corrosion, and always contains water. Then we need a thick film because in general terms the measure of protection afforded by a paint is proportional to its thickness, always granting that the film is hard, elastic and adhesive. There should be a greater effort to brush out the paint on metal than obtains in the case of wood, brick or plaster, because the pores of the metal are so much smaller that thorough application is needed to make paint stick.

The paint film should be thick, also, because it should be impervious to moisture, and the more pigment a paint film contains the more waterproof it is apt to be. It is a curious thing that linseed oil alone applied to steel affords almost no protection from rusting. It forms too thin a film, and one that

is porous; yet linseed oil mixed with red lead forms an almost ideal protective coat; one that is hard, yet elastic, thick, and very adhesive, for the pigment fills up the pores that exist in the linseed oil film. It is possible to mix as much as 33 pounds of dry red lead to a gallon of oil and still get good working qualities, and a paint that contains the maximum amount of pigment. Red lead is an inhibitor of rust, a preventive, and combined with linseed oil it forms the hardest elastic paint film we know of; water will not penetrate it; in fact, the marine underwriters formerly demanded an extra premium for policies written to cover steel ships whose hulls were not so painted below the water line. All the ships of our navy are so protected, as well as those of foreign powers. The huge steel members of the locks on the Panama Canal are likewise so protected. In fact, practically all structural steel is protected with red lead, both that belonging to the government and that erected by corporations or private individuals. Engineers and chemists agree that all steel structures should have at least two coats of red lead and linseed oil, followed by one or more finishing coats for decorative purposes. These coats should all be of a different shade so that the inspector can readily detect faulty work. No paint will protect steel unless it is honestly applied, and a little lampblack added to the red lead after the first coat will produce the necessary variations in the shade, as well as aid in securing a uniform thickness of film, and consequently uniformity of expansion and construction.

There are some rules that might well be observed in connection with the surface on which the protective paint is to be applied:

(1) The surface should be perfectly clean and free from moisture, greasy matter, rust and mill scale. No pains should be spared to insure a perfectly clean, dry, metallic surface.

(2) All minute holes, cracks, fissures between plates, poles and the like, should be filled with a suitable "filling" or "stopping" before painting is proceeded with. The condition of "metal-to-metal" is particularly objectionable, as local galvanic action is thereby excited, and this excites corrosion. A protective paint film to be effective must be continuous for the whole surface, and this result cannot be secured unless the said surface is made perfectly solid and continuous.

But paint will not prevent iron rust. The iron will rust beneath it, because the oxygen of the air will gain access to it sooner or later, and this, of course, causes oxidation of the iron. It seems, indeed, durable and useful as it is, that the purpose of iron, considered in itself, is to decay. Rust will continue even under paint, until the entire structure has become a mass of rust. Treated chemically or otherwise when being made, a surface can, possibly, be made that will prevent oxidation. Indeed, there is a non-rusting iron, I believe, but it is not practical for general use. White lead, which is carbonate of lead, and at one stage of its manufacture an oxide, is one of the very worst pigments to apply to iron. Zinc oxide also is bad, and will eat into iron. The marking compound used at the iron mills is not white lead, but a very cheap mixture composed mainly of whiting or barytes and oil, driers and benzine. There is no lead in it, lead being too costly. As to what constitutes the best paint for coating

iron, red lead is, according to the best testimony at hand, superior to anything else.

Metal Ceilings

Painting Metal Ceiling.—The manufacturers of metal ceilings that are to have the glazed effect, after stamping the sheets, dip these in a thin liquid, composed of varnish and naphtha, to which has been added some zinc white, but not enough to make the coating opaque; on the contrary somewhat translucent. When the metal is in place, the painter gives one or more coats of similar nature, tinted to meet requirements.

The first coat should be either raw or boiled linseed oil; if the former is used, then add a little litharge to help its drying. Don't add any pigment to the primer for a steel ceiling; white lead will cause the steel to rust. After this has been primed you may apply any sort of good paint.

Metal ceilings should be washed with sal soda water or benzine, to remove the grease, before painting.

A painter, writing to the *Carter Times* on this subject, says:

"Metal or steel ceilings for store rooms have become universally popular, and many of our painters in the smaller towns are not painting and decorating them to the best advantage. In order to get the best effect and properly distribute the light over the room, you should not use a gloss paint. Gloss paint becomes dirty and looks worn just as quickly as a paint that is flat or without gloss.

"One of our best decorators uses the following method, which can always be relied upon: Dust all

the dirt and clean grease spots from the metal; mix your first coat of white lead, half raw linseed oil and half turpentine; tint the same to the color you desire to finish with. When dry, coat over with a mixture of white lead thinned to the desired consistency with pure turpentine, tinted the same as first coat. The effect of this last coat can be improved upon by stippling it as you proceed with coating. The decorative work may be varied according to the price you get and the taste of the painter who does the work.

"Nothing looks so unprofessional to the trained eye as a fine designed metal ceiling 'smeared' over with a cheap 'ready-mixed' or gloss paint. Do not do cheap work on this class of painting, as it will add absolutely nothing to your credit, nor will it make you any profit.

"The flat effect does not show the defects as does the gloss finish. Do not spoil a steel ceiling with gloss paint."

Repainting.—When it becomes necessary to repaint an iron or steel structure the paint should never be applied in wet or freezing weather. The surface should be freed absolutely from all scale, rust, dirt, etc. It is not at all sufficient to merely apply a fresh coat of paint over an old paint surface under which traces of corrosion appear. Of course the new paint will cover up the old surface and often may adhere firmly to it, but corrosion goes on underneath the paint just the same. This proves that freeing from rust and corrosion and perfect cleaning are positively necessary. When, for some reason, it is not possible for the entire structure to receive a coat of some inhibitive primer, the parts cleaned

and freed from rust and all exposed surfaces, at least, should be touched up with either a lead or oxide primer before the finishing coat is given.

The use of turpentine in the paint applied over the old surface is advised, as turpentine is a penetrant, taking care of the penetration and adhesion between the old paint film and the new coat applied.

PAINTING GALVANIZED IRON

IGNORANCE of the proper way to paint on new galvanized iron sheeting or other galvanized objects results in considerable trouble and expense, and yet it is easily avoided. If the metal is allowed to stand to the weather for several months, preferably a year, the surface will be in a condition to take paint and hold it. But if the paint is applied as soon as the metal is in position, or if done within a few weeks of that time, the paint will in time scale off in small flakes. Then the trouble is to correct the evil. It may be scraped off with wire brushes, but should not be repainted until every particle of the original paint has come off, for otherwise it would scale beneath the new paint, and thus take all off. The better way is to treat the new galvanizing with this wash, which has been in use for many years, and with the surest results.

Take two ounces each of copper chloride, copper nitrate and sal ammoniac, dissolving the same in one gallon of soft water, then add two ounces of muriatic acid. This mixture must be made in a glass or earthen vessel. With a broad bristle brush apply a coat of this to the galvanized iron and let it stand until perfectly dry, when it will be ready for paint. At first the color of the coating is black, but this soon changes to gray. Upon this coating paint or varnish will adhere perfectly, and there will be no scaling. A gallon of this coating will cover about 25 or 30 squares of 100 feet each. It is inexpensive and easily made and applied. The ingredients may

be bought from any large dealer in drugs and chemicals.

Six ounces of copper acetate, (which is simply copper soaked in acid), to the gallon of water does the work equally well, depositing on the surface an adherent coating of black copper oxide, to which paint will readily adhere. As this salt of copper, containing a weak vegetable acid only, is so easily prepared, it is preferable to the chloride or sulphate, which contain strong mineral acids. The Government specifies the use of strong vinegar alone, and some painters advise a wash with strong ammonia water, allowing it to dry on and painting over it.

The railroad companies paint acres of galvanized iron surfaces every year, and usually succeed in making the paint stay on. A favorite method with some of the railroad painters is to wash the iron with benzine to free it from grease, then give it a coat of coach finishing varnish. Afterward the iron is painted with any good paint, but some foremen preper to add about a pint of good finishing varnish to each gallon of paint. This paint is applied to the varnished iron.

An old and successful master painter says that he simply washes the grease from the galvanized iron with benzine, and then gives it a thin coat (well brushed out) of mineral paint thinned with pure boiled linseed oil, and he says he has never known the paint to scale.

The master painter of a ferryboat and railroad company, in an article on this subject before a painters' convention, said: "I have tried vinegar, sulphuric acid, ammonia, muriatic acid, and a mixture of acids and chemical salts, as advised by trade journals, and the results from these washes have

been fair, but not uniform. There was as much peeling of the paint over these treatments as without them. I was careful, but never have been able to prevent the peeling. I found that galvanizing the iron was not a galvanic process. In fact, galvanized iron is made about the same way as tin, by dipping in a bath of molten metal. To prevent the contact of air with the molten zinc, ammonia is poured on top of it, and the ammonia clings to the sheet, and hence must affect the paint. Also the sheet is dipped in oil, to allow the draining off of any excess of zinc. This oil is non-drying and retards the drying of paint. It is well known that galvanized iron (steel always, never iron) is more rust-proof than tin, in the beginning, but it is nearly always less durable than tin after rust has started on it. This is due to the galvanic action between the steel and zinc, once the coating becomes broken."

A master car painter says: "I did a job of painting on galvanized iron twenty-five years ago, priming with French ochre, and following with two coats of best English white lead, sandpapered, and the paint is still intact."

As some galvanized iron is very thinly coated, it is best to paint it at once, before rust begins, which will occur if it is left to the weather very long, particularly where there is much coal smoke in the air. Such a roof should be painted at least within a year.

George Whigelt writes as follows: "To the painter who does not care to bother with acids or minerals when about painting galvanized iron, I would suggest the following method: Mix equal parts of spar varnish and turpentine, and apply. It would be best to sponge off the surface with white wine vinegar; this is a sure thing, as I have found

out by experience. After the varnish size, any desired paint may be applied, though the first coat over the varnish had better be mixed rather flat."

It is stated by some writers on technical subjects that the scaling of paint from galvanized iron is due to electricity, and that the white powder found beneath the paint on galvanized iron is simply zinc oxide, caused by electricity. This may or may not be true, but just here an incident that occurred in our experience will possibly in a measure either prove or disprove the electric theory. In painting the galvanized iron hoods on certain cars, it was found to be very difficult to prevent the paint from scaling, and later in order to counteract the effect of cinders, the hoods were painted with thick paint and sanded, which had the effect of preventing further scaling. Just what part the sand played in the matter is not altogether clear, unless it afforded a means of escape for the electricity, as it is apparent that the damage to paint caused by electricity is due to the fact that it has no means of escape.

Various reasons have been given for the peculiar action of paint upon galvanized iron. One of the most plausible is that the use of sal ammoniac in the process of galvanizing causes the formation of a thin film of the basic chloride of zinc on the surface of the metal being galvanized, which material, being a hygroscopic nature, acts as a repellant to prevent the close adherence of the paint to the metal, and the pigment dries as a skin over it.

Under no circumstances should a white lead or zinc paint be applied to a bare galvanized iron surface. Satisfactory results cannot be expected from their use.

A few years ago architects usually specified that galvanized iron should have three coats of paint, the second and third coats to be sanded. This was undoubtedly too much paint, and it caused scaling. The fewer the coats the better, and each coat should be thin and well rubbed out.

Care should be exercised in never applying more paint to a galvanized iron surface than is necessary to hide and protect the surface. The primer is a surface coating only and will in time break away if repeated coats of oil are applied over it. This is caused by the natural pull or tension of elastic coats under contraction and expansion.

Colors for Galvanized Iron Roofs.—In reference to paint for galvanized iron roofs. Though white roofs are objectionable in appearance, they are cool. Green and red may be more pleasing; they cannot be as cool as white. It is a question whether comfort is to be sacrificed for appearance. Refrigerating paints are sometimes supplied in tints of green and terra cotta, which are claimed to possess all the merits of white refrigerating paint. In some parts graphite paint is used for galvanized iron roofs; in other localities red oxide is used. Both are considered good rust resisters. The chief aim, however, of good roof paints, is to lessen the temperature. It is questionable whether any dark color is as successful for this purpose as white. It is generally known that white reflects both light and heat, while dark colors absorb these, which explains why white is more effective as a cooling medium than dark colors.

On galvanized iron the best adhering paints were found to be red lead, burnt umber and sienna, Indian

red, Prussian blue, lampblack and graphite, while the poorest adhesives were zinc oxide, lithopone, clay, silica, etc.

Repainting Galvanized Iron.—To repaint galvanized iron, note the character of the primer first applied; if well bound to the surface, clean thoroughly, and if to be painted a similar or darker color, apply but one coat. This should carry sufficient turpentine to penetrate into and bind well to the old coating. It should be well brushed and not heavily applied.

If two coats are necessary, the first coat should be mixed half flat and the finishing coat should carry a small amount of turpentine. Full oil reductions should never be used on a galvanized iron surface, as such will cause blistering under extreme heat.

If the surface is checked or cracked, go over it with a stiff wire brush and scraper, removing any loose particles of paint and thoroughly cleaning the surface. Touch up any bare spots with red lead paint. This will even up the surface, and it can then be finished with one coat of paint, which should not be mixed too elastic.

If the paint is peeling or is not properly bound to the surface, scrape thoroughly and clean with a wire brush to the bare iron then rough up the surface and proceed as for new work.

EXTERIOR COLOR SCHEMES

BY harmony is meant that perfect agreement of the colors, tints, hues or shades employed that will produce on the vision the feeling of perfect accord, no one color appearing more prominent than another, but all seeming a whole, like a well painted landscape, or, a still better comparison, the natural landscape, for we all must go to Nature for color harmonies. Some are said to possess a natural taste for coloring, an eye for color, as the saying is, but almost without exception any person will recognize the effects of good and bad color combinations. It does not require an expert colorist to do this. I have often been struck by the judgment of even little children in the matter of color appreciation, when painting, and considered their criticisms valuable, they being sincere, which is not to be looked for from most adults, and usually quite correct.

But color harmony is not mere personal taste or appreciation, it is a law, and because it is a law is why its perfect demonstration satisfies the normal mind. The green carpeting of the earth satisfies the mind, the coloring of the skies and waters and woods all pleases, rests and satisfies, because it is all according to laws of nature. Yet in house painting, while acting in accordance with color law, we have what we call rules of color, and these rules, rather than the more complex laws of color as the scientist knows them, are what we shall have in mind when treating the subject of color harmony and color combinations. We may

say that each house demands a special color treatment, this being a rule. The safe colors for a house are red, white, gray, yellow and brown. Yellow or gray suits many a plain, pitched-roofed or square Colonial house. Grays and browns are good for ugly, nondescript ones, the grays always being pleasanter on the yellow shades than on cold blue tones. White suggests the formal type again. White is a very good color for a country house, showing it up from a distance in fascinating glimpses, for it needs trees about it, and flowers to sparkle against its walls. Such a house will be attractive when the leaves are gone from the trees, for the bare boughs will serve to soften the effect.

A low-built, squatty house demands light and cheerful colors. Dark colors only emphasize its squattiness, while light colors have the optical effect of raising it higher.

Few greens are suitable for exterior walls of houses though an artist suggests terra verte and white, with a little yellow, as a good one for the purpose. However, slatey greens are good. Black, raw sienna and a touch of lake also are suggested. Certainly green should never be used where the house sits amidst much shrubbery and trees. In this case the house needs colors that will agreeably contrast and harmonize with the green growing things.

A Colonial style of house should never be painted in dark colors, such as brown, red, or other pronounced dark colors. Pure white, trim and all, will most always suit the case. In some other styles of houses white is good, and in some cases a dark bottle-green trim sets off the white to good advantage. An old frame or stone house looks well with white walls and green blinds, while almost any shade of trim will be

allowable. A stone farm house colored a very pale yellow, with white trim and medium green blinds, doors white or oak grained, makes a good effect. Or the walls may be a brownish-gray, and white trim, with a deeper brownish-gray for the blinds, or a dark green.

It may be laid down as a rule that a white body will admit of almost any shade of trimming. Say pea-green, gray, light yellow, or a very light brown trimming. A house painted in this way always presents a near, tidy perspective, while the architectural beauty is enhanced.

But if white has been used repeatedly, and the owner desires a little color change, a very agreeable one may be made by making the body of the house a warm drab, or gray stone, medium drab, light bronze, or ivory white, with white or colored trim.

Never follow color fads or fashions; be led only by good taste and simplicity, these being based on the laws of color harmony, and never change. A color scheme that is simple and fits the architecture and surroundings will generally be found pleasing and successful. What is desired is to make the painted house appear to fit into the place where it stands, and in order to effect this we must observe absolute harmony in the color scheme. We must take into account such matters as style of architecture, the presence or absence of trees and shrubbery, distance between houses on either side, and the color schemes used on neighboring houses.

Some houses, on account of their peculiar style of architecture, should be painted white, trim and body, but as a general proposition a building done entirely in white does not show up the structure to the best advantage. As a rule the white house would look best when trimmed with some color, such as bottle-green,

slate, medium drab, a drab produced with black and yellow ochre, a nice gray, etc. When thus trimmed the white house will show up ever so much whiter, and always the white should be white and nothing else. Some white leads are far from giving a white paint. Test different brands of white lead and see for yourself. The addition of zinc white as a finish makes a still better white, one that is not affected by sulphur, etc. But most too brittle alone, of which see more under another heading. However, where there is no soft coal smoke and little hard coal gases or other air impurities, a good really white white lead will make a very white job, because the sun and air will bleach out its oil and make it whiter still.

Success in using dark green for trim, says an authority, with the body white, depends on getting enough of the green on; that is, use the green on all of the trim, under the eaves, on the window sash, corner and baseboards, porch rail and floors, blinds, and on the foundation if possible.

It is useless to paint buildings white in places subject to factory smoke, dust and dirt, and the same may be said as regards all light colors or delicate tints or shades. But a French gray or a pearl gray will be allowable and will give quite durable colors under the circumstances. A light slate body with light gray trim and black sash, roof olive color, makes a fine color scheme. Another fine scheme may be had by making the body a medium drab, trim ivory white, and sash maroon. These are for city houses. Still another calls for Bedford stone body color, ivory white trim, and chocolate brown sash.

After determining the different points of location, surroundings, etc., as outlined above, you may find some one of the following dozen of color combina-

tions available. The colors named herein refer to body, trim and sash, in due order:

No. 1—Pearl gray, pure white, maroon.
No. 2—Cream, light brown, dark bottle green.
No. 3—Ivory white, pure white, maroon.
No. 4—Pure white, dark bottle green, black.
No. 5—Medium drab, ivory white, maroon.
No. 6—Chocolate brown, pure white, white.
No. 7—French gray, pure white, maroon.
No. 8—Colonial yellow, pure white, white.
No. 9—Bronze gray, pure white, maroon.
No. 10—Fawn, pure white, maroon.
No. 11—Bedford stone, ivory white, chocolate brown.
No. 12—Slate, pure white, maroon.

Here is another table of harmonizing colors for house exteriors:

Colonial or Formal—Body white, yellow or gray; trim, white; roof, natural wood shingles or slates; blinds, moss green, bronze green or green.

Picturesque or Irregular—Body, red; trim, red with white sash; roof, natural shingles; blinds, very dark green. Or, body brown; trim, creamy white; roof, moss green, and blinds medium green.

Mansard Roof—Body, yellowish gray; trim the same; roof, usually slate; blinds, green.

Small Cottages—Body, red; trim, if not much of it, white; shingles, natural. Never use red if slate roof is blue. Blinds, dark green.

Upper and Lower Story is Different—Body, red below, gray above; trim in either case to be self-colored and sash white; roof natural shingles, and blinds dark green.

Cement and Stucco—Body, white, yellow or gray; trim, brown stain, for white and yellow, and white for gray; roof, in all three cases, red; blinds, for first two cases, for gray body use a pale blue-green.

In suburban places it is well to select colors that will not duplicate others near by, no matter how beautiful and correct those may be, but select colors that will harmonize with surrounding color schemes, seeing that contrast of colors make a more interesting display under the circumstances.

Summer cottages are usually built for pleasure or pastime, or at best are temporary houses, hence should be given a light and bright coloring. The more solid and sober city house demands an opposite treatment, and if decked out in the coloring that would become the summer or suburban cottage would look quite ridiculous.

If more than one color is to go on the side of a house, see that the heavier or darker color is not placed above the lighter one. Dark coloring conveys the idea of weight and solidity or strength, and should not be held up by light colors, which have the aspect of being weak. This color rule holds good also in interior work, as will be mentioned in its proper place.

In brick and stone buildings the window frames should be painted the color of the capstones and window sills. For instance, a brick house, ornamented with limestone copings, should have the frames painted a light graystone color, with the sash black or dark green.

A city house on a small lot, near the street, should be painted a quiet color, with dark trim.

Quiet colors, pure white in particular, are growing more and more in the popular esteem.

In painting business or factory buildings, where there are heavy members carrying heavy loads, these should be done in the darkest colors used in the scheme, while those with the lightest loads to carry should be

done in the lightest colors used, so as to appear more slender.

A light, airy structure will look stronger if a dark paint be used, unless the background is dark, when a light colored paint affords relief. With a small structure, in a large or deep landscape, more attention should be paid to the matter of contrast.

A good color scheme for the exterior of a handsome private stable is as follows: Paint the weather-boarding a dark drab, the stall blinds a dark drab, rain conductors a dark green, doors green with drab panels, sashes Indian or tuscan red. If there are shingles on the sides, oil them, and the same if the sides are brick. Roof shingles dip and brush-coat red. Interior woodwork finish natural.

Here are a few practical color suggestions from a prominent architect:

A good combination shows a rich olive body with white trim. Roof moss-green. Side gable deep buff. Sash a greenish-black, and door deep green. Make the porch floor a green between the door and body color. The foundation a sandstone tint, and the chimneys a cream.

A low-posted cottage would be very attractive with the body white and the trim the same, the porch floor a mossy-green, or a burnt sienna, the roof stained olive green, with chimneys and foundation red. A good alternative scheme would be a copper-red roof and white body, giving a crisp and attractive effect.

A very attractive little house may be made by laying the lower story in chocolate color, and by painting the upper a lighter chocolate to harmonize with the brick: the trim should be white, the sash deep maroon, and porch floors and steps painted very deep and dull yellow. With the roofs stained brown, and the brick

chimneys to match the lower story, the result would be most pleasing.

A rather deep lemon yellow is suggested for the body of a simple house, white for the trim, a soft, harmonizing green for the gables, the sash in black, the roof moss-green, and the foundations and chimneys of red. This color scheme makes a good background for shade trees and shrubbery.

A house made for two families and the lot small, requires a color scheme that will tend to make the building recede rather than stand out. A square form would suggest a modest color effect. A deep seal brown throughout, black sash, warm green roof, and red chimneys, porch floors and steps a very dull buff, ceiling of porch cream, will complete a very good color effect for this case.

An attractive color scheme shows a green shingled effect with white trim throughout, but in case siding must be used, lay the chimneys in cream brick. Stain the roof golden brown, paint gables and body tan, bordering on the chocolate, make the sash a deep brown, trim with a good white, paint the porch floors with Vandyke brown, medium shade, while the brick foundation should be painted to match the body.

The location of a square house should almost of necessity be known, in order to wisely plan its color scheme, for its form is so easily accentuated to the detriment of the design, whereas, it might be as easily, with a little thought, subdued and improved upon. Assuming that the house occupies an ordinary level city lot, we will paint the lower story and trim a very deep, dark green; the upper story a deep, dull pumpkin shade, and the roof a moss-green. The chimneys and all the brick work should be red, and the sash painted

greenish-black, while the porch floor should be olive green, and the ceiling cream color.

Here are some further color combinations that will prove useful suggestions. The first color is for main body of the work, and the second color for trim. Sash, porch floors, roofs, etc., are not included in this table, which merely gives some suitable two-color combinations:

Warm gray and yellow sandstone.
Warm gray and pale sienna yellow.
Cool gray and orange sandstone.
Pale cool gray and yellowish white.
Yellowish gray and red sandstone.
Mansfield stone and slate gray-green.
Reddish gray and terra vert green.
Reddish gray and toned yellowish white.
Grayish red and green slate.
Grayish red and pale sandy yellow.
Yellowish stone and reddish gray.
Warm sandy stone and white.
Pale terra-cotta red and deep terra vert green.
Two tones of any one color, but for grays the deeper to be the general wall color, and for warm tones the reverse.

Painting Store Fronts

This matter was thought of sufficient importance by the Canadian Hardware Association as to justify its discussion at one of their annual conventions, and the conclusion they came to was, the black, or aluminum and natural finish or cherry, with the interior of the place cherry, or outside white and inside a dull red, was best, thus agreeing that the inside must be taken into consideration when determining the outside color-

ing. Some thought with cherry or bottle green outside, a natural finish would look best inside. White enamel for outside was also considered good. Indeed, a white outside with a dull red inside was very well thought of.

There are many suitable colors for shop fronts. As a rule they should be strong, decided tones, either very light, such as white, ivory white, cream, or biscuit colors, or very dark, such as bronze green, or other dark green tones. Deep Brunswick green supplies a good color, or shades of green made with Brunswick green and Prussian blue used alone or lightened with white. Dark peacock blue is a pleasing color. Weak tints or common shades should be avoided. Dark reds and leather colors supply a useful range. Common shades of green and red, all right in themselves, have become too much hackneyed for pleasing results. The painter should evolve shades which are out of the beaten track. Pure red makes a striking color, but it is not one which harmonizes well with display windows unless carefully managed. A little pure red, such as vermillion, introduced, say, round the window sash, is effective, with darker reds or warm toned colors. Aluminum powder may also be applied with good effect. Sometimes a shop front is the better for being treated simply and broadly, but if elaborate color treatment is desired, we know of nothing better than a scheme of contrasting shades, such as shades of chocolate. Quaker green and cinnamon, with lettering in gold, or cream, outlined. As to whether light or dark shades are most permanent: Light colors, as a rule, are. White and cream last well. All dark colors should be used flat and varnished. The aim at all times is to produce not only a striking front, but one which will harmonize with the goods displayed.

A prominent decorator says: "For the lower parts of houses with shop fronts, and for the doors and windows, I cannot do better than recommend rich browns, deep olive-toned greens, brownish reds and red purples. Blue is sometimes successful if a deep, pale color, such as one finds used upon carriages.

The white shop front does not appeal to me as at all effective. It detracts the attention from the goods in the window.

I can conceive of no more suitable coloring for the woodwork than a deep brown of oak or walnut color, and for the metal work a bronze green or brass or copper color. A certain amount of gilding enlivens and renders more attractive, but requires more judgment than is usually bestowed on its form and position. Much more use might be made of aluminum and silver-leaf, and of copper- or metal-leaf, properly lacquered and protected.

I prefer one color for doors and have little appreciation of parti-coloring for shop fronts or front doors. If relief is required it is better obtained by a few simple lines and some color or gold upon the mouldings and enrichments.

The following suggestions may be useful for shop front coloring. The first color is the house front above; the second the sash frames and the door frames, etc.; the third the shop front woodwork:—

Warm gray; sienna yellow; rosewood brown.

Gray stone; white; olive brown.

Yellow sandstone; greenish gray; medium oak.

Cool gray; yellowish terra vert; deep purple brown.

Warm slaty tint; green slate; deep blue.

Any of these schemes will be improved by a judicious use of gilding—not in petty stencilling, but in fairly large masses of enrichment or as lining or lettering.

Another decorator, writing upon the subject in an English publication, says: "To make the front of a shop attractive, we know of nothing better than finishing it so as to give a true bronze effect. This may be done on either iron or woodwork, and if properly applied the appearance of the finish will stand indefinitely. To prepare the surfaces they should first be given a coat of white lead, and afterwards two coats of aluminum liquid. When thoroughly hard, color with a coat of pale outside varnish, and when this is nearly dry dust over with dry aluminum powder with a camel's hair brush, and polish the surface afterwards with fine cotton wool to get brilliancy. Finally make up a transparent scumbling, made with varnish and a little boiled oil so as to flow, going over a section at a time and stippling gently so as to make the surface agree, and finish up and dry with a coat of varnish. Aluminum or bronze of any kind will stand well as long as it is not in contact with oil, paint or varnish, but is kept apart by a thin film of lacquer, spirit varnish or gelatine, or celluloid, which in its turn requires a protection of oil varnish. The point is to keep the air off it so as to allow no time for oxidization; therefore it should be laid upon a japan varnish or gold size and be sized with pure gelatine as soon as laid."

From another English publication. Woodwork for a draper's shop:

1. Finishing coat, black japan with a little orange chrome added; decorate with fine lines of orange vermilion.

2. Finish black japan with yellow chrome added, and line with green made of yellow chrome and a touch of black.

3. Finish black japan with vermilion in it, and line or decorate with silver, or with an ivory color, rather deep.

Color For Walls and Doors.—A good soft green, says *Arts and Crafts,* that may be used in large quantities without being staring, may be made by an admixture of raw sienna, green lake (light), and Venetian red and white, or another tone by raw sienna and indigo. Dutch pink and white (Dutch pink is much used by paperstainers, and helps to make a number of those soft, light greens used on the grounds of their papers), or raw sienna, Antwerp blue and burnt sienna also make a good, soft green. A good color, somewhat resembling the old tapestry, can be made for a library wall by mixing middle chrome, Vandyke brown and mineral green with white or Prussian blue, ochre, and Venetian red. A good rich reddish-brown may be had with orange chrome, Vandyke brown, Venetian red and white; a brighter with vermillon, brown lake, and Vandyke; rich buff, with orange chrome, burnt sienna, and a little raw sienna and white, or Dutch pink, burnt sienna and white; a soft warm gray, with Indian red, blue black, burnt umber, and white; a beautiful clear, though rather a cold gray, with ultra-marine and burnt umber and white; a rich salmon color, with middle or orange chrome, vermillion, and burnt sienna with white. You may give a rich though somewhat dark effect to a door by painting it a little reddish brown and then stippling over the panels coarsely, so as to show the ground, with a mixture of brown lake and Vandyke, the stiles being painted Vandyke, with some brown lake in it, rather thin, but stippled very close and fine, sufficiently solid, however, to look several shades darker than the panels;

the prominent members of the mouldings may be the light reddish brown, ground color, and the sunken hollows Vandyke and brown lake, quite solid. A little added ornament on the panels in the light brown will give a very rich effect.

PIGMENTS USED BY HOUSE PAINTERS

ONE of the most desirable features in painters' colors is purity of tone. For comparison it is well to have on hand artists' tube colors, those corresponding to house painting pigments. Compare for purity of tone, fineness of grinding and tinting strength. You will find this interesting and useful. Place some pigment in oil on a piece of glass, and on that place another piece of glass, then rub the two together, after which examine the glass for scratches, in the pigment, if not on the glass. Or spread some pigment on glass with a spatula, and hold the glass to the light of the sun, or any intense light. A pure color coarsely ground will prove a poor tinter. Or place some color in a tube and thin out with turpentine, or benzine, and shake it well; relative fineness of grinding may be determined by the time it takes the color to settle, coarse particles settling at once. The residue may be laid on some blotter paper and examined with a lens of five to ten diameters.

Or weigh out equal amounts of pigment and add to white lead or zinc white; observe depth and clearness of tint given.

Test dry colors for fineness of grinding and presence of make-weights by placing in a tube with two-thirds water and shake; pour off the water before the color has entirely settled, and repeat until the residue is obtained. Allow it to dry, then examine for granular impurities.

The pigments or colors used by house painters may be divided into two classes: First, the natural earth

colors; second, the chemical colors. A third class might be made of the earth colors containing more or less chemical colors, as Venetian red, Indian red, Tuscan red, etc. Again, the class of chemical colors may be divided to take in those that have some inert base added, such as chrome green, which is improved by the addition of considerable base material.

UMBER.—There are several grades of umber, but the best is Turkey umber. It has a warm, violet-brown color, while some other umbers have a rather yellowish tone. Raw is the natural umber, its color being greatly improved and altered by calcining it; the burnt umber is mostly used, there being very little call for the raw. With lead or zinc white, umber makes very pleasing colors, and alone it is a very useful pigment in graining, for walnut, and in stippling. It is one of the most useful pigments for the painter's use. Used as a body color, however, umber is liable to fade in the course of time.

An imitation burnt umber may be made from a mixture of red, yellow and black, which gives a solid color, though not so transparent a color as the true umber. In other ways, the imitation works about the same as the real pigment, and can be used wherever umber is useful.

VANDYKE BROWN.—An earth pigment, probably the result of the decomposition of lignite or brown coal, blackish-brown in color, smooth and very light. Very transparent, a durable pigment, but of very little use to the house painter, though the grainer employs it in his work. Tints with lead cannot be made satisfactorily with it, for it gives only muddy tones. There are several varieties of Vandyke brown, but

all are stable pigments, neutral with other pigments and bases.

YELLOW OCHRE.—This is one of the most useful of all the pigments painters use, or misuse, for it is that, often. There are various grades, the French the best. The difference between the French and American ochre is that the former has a silicate base, while the latter has a clay base, and as clay absorbs water readily, the ochre containing it is defective as a paint to that extent, at least. Drawing moisture, the clay ochre causes blistering and scaling. Yet an American ochre of the best quality has three times the strength of the French ochre, but when mixed with white lead it gives only a dull tone, the French ochre giving a clear, bright tint. Nor does the American ochre work as well under the brush, nor cover half so well as the French ochre. The latter is, therefore, the cheaper of the two. The select brands of French ochre are valued on account of their uniform bright yellow color, which approaches that of a chrome yellow tone. The U. S. Government specifications require in French ochre at least 20 per cent. of oxide of iron, and not more than 5 per cent. of lime in any form.

French ochres are branded as to color, tone, shade and quality by letters, each of which has a distinct meaning. They are not really intended to designate any standard, but to give the consumer a certain guide as to purchasing value. It is for the consumer to protect himself by asking for samples and testing the same in comparison with such standards as he may have, before purchasing in quantity. The letters are the initials of French words, as follows: J stands for jaune (yellow); F for fonce (dark); L for lavee (levigated); S for surfine (superfine); E for extra,

superieur or superior, and C for claie (pale or light). So, for instance, J. F. S. means yellow dark levigated superfine, while J. F. L. E. S. means yellow dark levigated extra superfine. When the letters are confined to J. F. it simply means dark yellow, or J. T. L. would mean dark yellow washed ochre. When the letters are J. C. L. S. it means that the ochre is designated as citron yellow washed superfine, and J. O. L. S. means yellow golden washed superfine, the O standing for or (gold). When the brand designates French ochre as R. L. S. it means red washed superfine, R standing for rouge (red). R. L. S. would mean dark red washed superfine.

Yellow ochre should never be used as a basic pigment for first coats on exterior wood. Some ochres are amorphous, or composed of a large percentage of alumina (which is practically clay); others are crystalline, or composed of silica (which is practically decomposed stone). The former when thinned with raw linseed oil and used for priming, will never dry hard, but remains soft and spongy under all succeeding coats, until the time comes when blisters are caused by exterior heat and a soft priming. This trouble rarely develops until the work has stood for ten years or more, and has been repainted once or twice during that time.

Yellow ochre, whose nature is crystalline, is a much better filler for priming coats, and is less liable to cause trouble than the softer ochre, but when it dries thoroughly hard it is difficult for softer pigments to find a secure anchorage on this priming. The result is blistering or scaling.

In some parts of the country, particularly in the west and south, there is a preference for ochre priming, and this practice has been much discussed in the

trade journals and at the master painters' meetings, the unanimous verdict being against the practice. Some use all ochre, others only a certain proportion of ochre, with white lead as the main pigment. Then there is a wide difference of quality between ochres, from the cheap, coarse American, to the finest French ochre. The latter alone should be used in priming, if one will use ochre for that purpose. It is a very well established fact that ochre priming will cause paint scaling, and even the use of a small amount of it in the priming causes some scaling. The reason for this is that the ochre is a very hard pigment, and its hard, dry surface will not take lead paint well, or not hold it perfectly. Besides which, ochre is merely a clay colored with a little iron. If the ochre is used on the score of economy, it is a very dear sort. But many say it is better in every way than lead for priming, which statement is not borne out by facts.

Why Ochre Should Not Be Used As a Primer. —1. Domestic ochres are not fillers. They plaster over the grain of the wood without filling in.

2. They are susceptible to moisture and mildew.

3. It is impossible to thoroughly incorporate ochre and oil by hand. If such a mixture is applied to a soft surface it will fail to bind and satisfy the surface with oil. On a hard surface it will slip over without penetrating, and if elastic finishing coats are applied they will break loose and peel off in a short time.

4. It is difficult to keep a yellow ochre primer of a uniform consistency while working.

5. The material is so light, and works so easily under the brush that too heavy a coat will have been applied before this condition is noticed.

6. Ochre is of a much different composition, chemically and physically than white lead, and leaves a much harder surface and less porous, if ground in oil by machinery; therefore finishing coats will not bind unless this feature is understood and the finishing coats reduced and applied accordingly.

7. While ochre leaves a hard, flinty surface, nevertheless in case of hand mixture the surface is porous and full of air spaces, and requires a first coat reduced sufficiently with oil and turpentine to satisfy the unsatisfied ochre on the surface as well as the wood. This condition not being understood in the majority of cases, one coat is likely to be applied, resulting in peeling.

8. Ochre is a slow drier, hence is apt to be undry as a priming coat, resulting in peeling.

True Golden Ochre.—Golden ochre is not simply yellow ochre tinted with chrome yellow, though such golden ochres are made. The true golden ochre may be made in the factory from this formula:

Barytes	550 lbs.
Best American ochre	230 lbs.
Nitrate of lead	29 lbs.
Bichromate of potash	15 lbs.
Glauber salts	12 lbs.
Sal soda	6 lbs.

This formula produces an ordinary lead chrome thrown down on a base consisting of barytes and ochre. Further description of the process may not be necessary, as the intention is here merely to indicate what a true golden ochre is.

Golden Ochre.—A sample showed 60 per cent. of whiting, with some barytes, chrome yellow and red ochre. It was labeled "Golden Ochre, Washed." You

can make a golden ochre with best French ochre in oil, and tint it with medium chrome yellow; for a darker shade use orange chrome yellow in place of the medium shade.

SIENNA.—Properly speaking, the pigment sienna is only a yellow ochre of a deeper or browner color. Some writers class both under the head of ochre. They consist essentially of an earthy base colored by oxide of iron or manganese, or of both. A good sienna should show very little grit under the palette knife, and should have good coloring strength, which point may easily be tested by tinting white lead with it. For transparency try it as a glaze over a graining ground. Raw sienna is much lighter than the burnt, which has a very red cast. The raw is useful in making oak graining color, and the burnt in making cherry stain and graining color. Both are very useful tinters, also, producing with white lead or zinc very beautiful colors, which are much used in exterior and interior painting and decoration. The Italian brand of sienna is best.

YELLOW.—The most important yellow pigment used by the house painter, and about the only one, is lead chromate, or chrome yellow, of which there are several shades. The lighter shades usually contain lead sulphate, as well as lead chromate, while the deep orange yellow contains some basic lead chromate. Pure chrome yellow should contain only lead chromate, lead sulphate, and possibly some basic lead in the deeper shades. Lead sulphate may be replaced by other insoluble compounds. A chrome yellow should be considered adulterated if it contains anything besides insoluble lead compounds. Chrome yellow is

often adulterated with whiting or barytes, as well as with lead sulphate. Pure lead chromate has an orange-yellow color, and no matter how made, it always has this color. But color makers produce several shades from the orange to the pale yellow or so-called lemon yellow, the light colors being impure, of course.

Zinc chrome yellow is costlier than lead chrome, and not much in demand, being specially useful where a yellow is required in the presence of sulphur, whether in pigments used in its connection or in the air. Zinc chrome yellow is far inferior to lead chrome yellow in point of coloring strength, but it is not poisonous and is faster to light. While lead chromates vary much in color, it is nearly impossible to get any variation of color in zinc chrome.

So powerful in tinting strength is lead chrome that as much as 50 per cent. of adulteration may be used and still the color will pass as pure.

True Vermilion.—The term *genuine vermilion* can only be applied to the red sulphide of mercury, HgS. True vermilion is invariably of this composition, although the source or origin of pigment may vary. Thus there are the Chinese, English and German vermilions, and these may be made by the dry or the wet process; the composition of the product is always the same, and only sulphide of mercury can claim to be called vermilion.

English vermilion is a sulphide of mercury. It and the French and Chinese vermilions are made on this formula: 200 parts by weight of mercury or quicksilver, and 32 parts by weight of sulphur, the chemical combination being sulphide of mercury. The Chinese vermilion is rather a finer product than the others. How the Chinese discovered the secret

of making this beautiful chemical color with absolutely no knowledge of chemistry, is one of the unfathomed mysteries.

True vermilion has good body and covering capacity, but is affected by light, which in time changes it to a dirty brown.

True vermilion should show no bleeding on boiling with alcohol and water, and no free sulphur by extraction with carbon disulphide. A small quantity mixed with four or five times its weight of dry carbonate of soda and heated in a tube should show globules of mercury on the cooler portions of the globe. The best test is for purity of the ash, which should not be more than one-half of one per cent.

An imitation vermilion can be detected by the presence of aniline, with which most all imitations are colored. Place some of the dry pigment in the palm of your hand, and note whether it leaves a rose-pink discoloration or not, and which stain will not easily wash away with water; the stain left by true vermilion is easily washed off with water. The true vermilion is a very heavy pigment, and when pressed with a spatula will pack, while the spurious article will be fluffy, and will not pack. Genuine vermilion is now very little used, organic lakes being used for the most of the brilliant scarlet, red and vermilion shades; these organic colors are also used sometimes for precipitating on red lead, orange mineral, or zinc oxide, but as a general thing the base is barytes, whiting or China clay.

American vermilion is a chromate of lead color, very permanent, but a very poor coverer, and not much used now.

The eosine vermilions are imitations, described above. They are simply red lead, or barytes, or whit-

ing and clay, some of these being used with the red lead. These eosine or aniline vermilions fade badly in the light, and in a very brief time, changing to a dirty pink color.

The Para reds have about replaced the eosine reds, for they are quite permanent, very cheap, and cover well, though not as well as the eosine vermilions. The Para reds may be placed in three distinct classes: Those containing barytes and zinc as a base, those containing red lead, and the Para red lakes, containing alumina, whiting, etc.

Red, Light.—This is simply yellow ochre calcined to redness. It is a permanent color and a good drier.

Prussian Blue.—The two blues of importance to house painters are Prussian and ultramarine. Under the name of Prussian blue are included all ferro-cyanide blues, such as Antwerp, Chinese, Turnbull's, etc. These blues are all ferric ferro-cyanides, or double iron potassium salts of hydroferro-cyanic or hydroferri-cyanic acids. Prussian blue is obtained from sulphate of iron and sulphuric acid in solution, and yellow prussiate of potash in solution. It is an extremely strong color, and hence valuable in tinting. It is too transparent to be used much as a body color. It is a permanent color, though it has a slight tendency to fade if exposed to a strong light too long. Its covering power is defective, this owing to its transparency. Lime and alkali will affect it, giving it a rusty appearance; while acids deepen its color. Mixed with zinc oxide it forms a fine color and covers much better.

While these blues of the ferro-cyanide order would all analyze the same, chemically, there is quite a dif-

ference in them, physically. Prussian blue, proper, when mixed with the white pigments, produces a light blue shade, slightly purplish and grayish, while the Chinese, etc., blues of the same order, give a clearer and more true shade of blue. There is also a difference in strength of coloring power.

Prussian blue is most useful to the house painter when in a slightly adulterated form, strange as this may appear. When ground in oil as other oil colors are, it is apt to become livery, hence must be ground in a special oil. It is a very bad drier, and exerts a retarding action on drying-oils. Fortunately a very little of this blue suffices to tint with.

Celestial blue and Brunswick blue are only reduced or adulterated qualities of Prussian blue, frequently containing 5, 10, and 12 per cent. only of Prussian blue. If barytes be taken and on it be struck Prussian blue to the extent of 12½ per cent. of the total weight of pigment, a product is obtained which, when ground in oil, gives an exceedingly intense dark "Royal" blue. But when so reduced the blues should be sold for what they are.

Lime Blue.—This is simply a common grade of ultramarine blue, and is not to be used for tinting, as its color is not reliable, and it is coarse. Ultramarine blue is not affected by alkali, lime, etc., but is affected by sulphur. Hence changes in white lead paint. Prussian blue also is affected by alkalis.

Ultramarine Blue.—Ultramarine blue is a compound of unknown constitution, being made by heating clay, soda, sulphur and charcoal together. It appears to be a complete silicate of aluminum and sodium. On account of the sulphide present it cannot

be used with lead pigments. Good ultramarine gives little tarnish on polished copper. It may be told from Prussian blue by being dissolved in hydrochloric acid with the evolution of hydrogen sulphide.

Ultramarine blue is little used in house painting, because used by itself it is too bright a blue, and it does not produce as clear a light shade of blue on a white base as the Milori and Chinese blues.

Chinese Blue is a variety of Prussian blue, possessing a much clearer tone and better keeping qualities. It is simply a superior form of Prussian blue. Any Prussian blue made from cheap grades of prussiate of potash will have a dingy color; hence a good test is clearness of color tone. The prussiate blues also have a tendency to fade on long exposure to light.

Chrome Green.—The most important green is chrome green, which is a mixture of Prussian blue and lead chromate. A green made of ultramarine and zinc is occasionally found. If absolute permanence is required chronium oxide is sometimes used, but this pigment is not common. The very brilliant copper arsenic compounds, Paris green, etc., are little used in paints.

A pure chrome green should contain only Prussian blue, lead chromate, and lead sulphate. Greens made by precipitating the ingredients together are superior to those made by mixing the blue and yellow after they are precipitated separately. To distinguish the two rub the pigment in oil and allow it to stand. A badly-made green will show blue, but one properly made by precipitation will not. Under the microscope a badly-made green, in the dry, will show blue and yellow particles, as well as green. A well-made green will show green and some blue particles, but no yellow.

For body work, or when the green is used by itself, greens containing from 70 to 95 per cent. of adulteration may be used; and the covering capacity is little impaired, even indeed when the amount is not above 80 per cent. China clay, barytes, and terra alba are the usual adulterants. The same may be said of Paris and ultramarine greens. They stand the light well, but are affected by lime, which turns the blue of the green a rusty orange color.

PARIS GREEN.—Emerald green. Years ago much used in painting window blinds, Venetian blinds, etc., but so very poisonous that chrome green was devised to supersede it. It is sometimes added to chrome green to liven the latter. A very poor covering color, one of the worst we have.

ULTRAMARINE GREEN is quite permanent, but is very seldom used by the house painter, though the interior decorator or frescoer finds use for it. It is too transparent to use excepting as a fresco color.

LAMPBLACK.—Black pigments are practically all carbon black, in one form or another. Lampblack is a finely divided carbon, obtained by collecting the smoke produced by burning oils, with the admittance of a supply of air sufficiently reduced to prevent perfect combustion, the aim being to consume all constituents of the burning body but the carbon, and to preserve as much of that as possible.

Pure lampblack is a permanent color, and extremely durable. While not of itself a very pleasing color, yet it is about the most honest and dependable we have. Will last longer and stand heat, cold and weather better than any other pigment or combina-

tion of colors. It is a slow drier, yet will dry within a reasonable time; the addition of some Prussian blue will make it dry better and not affect its color. It is so fine that no mill could possibly grind a pigment as fine as this. Lampblack is sometimes added to other blacks to improve fineness and durability.

Natural gas lampblack is free from mineral impurities and unburned oil, and possesses a full color. Very durable and fine, altogether desirable as a pigment.

Blacks, alike chemically, may behave very differently when ground in thin varnish. For example, lampblack mixed with such varnish in a ratio of 20 to 100 has flow, while gas black, similarly treated, has no flow.

Blacks are occasionally adulterated with Prussian blue, and it is said that at least one black on the market contains a large amount of magnetic oxide of iron, which may readily be detected with a magnet. Lampblack will stand 50 per cent. of adulteration with barytes or whiting and still look good.

Carbon black is not a good drier, in fact it is almost impossible to make it dry.

As a general rule, the lighter and bulkier the lampblack, that is, the smaller the amount that can be packed in a given space, the greater the amount of oil which it will absorb, and the greater the tinting strength, regardless of tone, pound for pound. Two blacks, dry, of equal strength, one requiring more oil in grinding, will show a good test. The one requiring the most oil will produce the weakest color in oil, while a more expensive but stronger black, absorbing a larger amount of oil, may produce a paste both stronger and cheaper. Thus we see that there is more

in the selection of a dry lampblack than mere strength alone.

To test lampblack place some on a tin lid and hold it over a flame until the mass has burned for a few minutes, when the remaining powder will show all the characteristics of lampblack, namely, a powder perfectly smooth under the palette knife, and black in color. Pure gas black, after burning, will show a slightly gritty residue, of a brownish-black shade, caused by the drying material ground with it. With an adulteration of 50 per cent. of barytes, lampblack will show a residue of white, with streaks of uncalcined lampblack. Gas black, with 50 per cent. whiting, will show a residue of dirty white color, with brown-black streaks of unburnt material.

For tinting purposes, it is said that a lampblack adulterated with as high as one-half barytes is better even than the pure article, but the price should be correspondingly low.

Drop Black.—Ivory drop black should be made from calcined ivory, but seldom is. It has a rich, velvety black color, while bone black has a reddish cast. Bone black is called ivory black. The name, drop, comes from the manner of making it; the dry powder is mixed with a little glue size and is allowed to fall in the form of cone-shaped drops, which are then dried and sold to color grinders. Pure ivory drop black will resist sunlight better than any other black excepting, perhaps, lampblack. It is considered to be the most permanent of all the blacks, not excluding lampblack. In making tints of gray with black, remember that lampblack and drop black make different tints, the latter making a softer tint, the former a colder gray. A little burnt umber is good in making a gray tint with black.

INDIAN RED.—This fine red, when pure, consists almost entirely of iron oxide; it is one of the best covering colors we have.

TUSCAN RED.—This beautiful and very popular red is simply Indian red toned with rose pink or aniline dye, hence to that extent it is less stable than the Indian red. It loses its rich coloring in time and goes back to its original Indian red color. Tuscan may be adulterated as much as 64 per cent., and pass, but such adulteration is less frequent now than formerly, and threatens to become a lost art.

Genuine Tuscan red, the dyed Indian red, being merely an imitation, is made by calcining iron oxide until it acquires a purple shade, the so-called Indian red. This is then toned up with alizarine lake, washed, dried, ground, bolted, etc., and then is ready for grinding. The imitation Tuscan red is composed of a cheap base, like whiting or gypsum, and dyed with aniline. Such imitations are more brilliant than the real thing, but they soon fade and look bad.

VENETIAN RED.—This may be properly included under the head of paint bases or paints, as it is very seldom used for tinting or general house painting, unless it be for the tin roof. It fades badly when mixed with white lead, and fades quickly, too. It, however, holds very well with zinc white. It is an oxide of iron combined with lime. The U. S. Government specifications require at least 40 per cent. sesquioxide of iron and not more than 15 per cent. of silica, and the remainder of lime rendered incapable of taking up water of crystallization. The best grades contain sulphate of lime, and the cheaper grades, carbonate of lime. The more oxide of iron present, the

stronger the color, and, if finely ground, the greater the covering capacity. The Venetian reds are not much affected by the elements, but sometimes fade when an excess of carbonate of lime has been used in their manufacture. The darkening of this red is often due to sulphurous fumes, smoke, etc.

A Venetian red that looks bright when dry, but when mixed with oil shows up dull, may be regarded as of bad quality. Always test dry colors by mixing in oil before buying.

Inert Pigments.—When oil is mixed with the chemical pigments, such as lead, zinc, yellow chrome, Prussian blue, etc., there is a chemical union, and chemical reactions occur between the oil and the pigment, to the injury of the paint.

When the earth pigments, the ochres, siennas, umbers, etc., are mixed with oil there is a mechanical union, like the mixing of sand and water; there is no chemical union or reaction. Hence we call such pigments inert, and to this class belong barytes, silica, terra alba, etc. When inert pigments are added to chemical pigments there is an absence of chemical reaction, to a very large extent, at least. The various substances used as inert additions to paint are barytes, whiting, gypsum, kaolin, pulverized silica, soapstone and ground feldspar. Gypsum is probably the best to use with pigments. It is of great durability, chemically inactive as a pigment, of low specific gravity, and can easily be ground and incorporated with pigments or paints, and does not settle rapidly in the paint pot. But should water get into the paint mixed with gypsum it is apt to liver up.

Zinc White or Zinc Oxide.—There are two methods of making this excellent pigment, the French and

the American. Briefly the former consists in preparing it from the pure zinc metal known as spelter; the other way is to treat the ore. The French process naturally gives the finer article, one that is of the utmost whiteness; the American process zinc white is somewhat harsher of texture and not so white. Chinese white is only another name for the French process zinc white. French zinc is particularly useful for the artist and the interior decorator, while the American process zinc white is very good for outside painting. Some Western brands of zinc white contain a small percentage of lead sulphate, but this is not considered to be in any way harmful to a paint made from it, either for exterior or interior work.

Chremnitz, Chinese and Florence White.—The first named white is the best selected white lead ground in damar varnish. Chinese white is a fancy name for zinc oxide white. Florence white, sold in paste and liquid form, is French process zinc white, ground in damar varnish.

Lithopone, or zinc sulphide white. A white powder resembling zinc white in appearance, but of heavier gravity and not as great an absorber of oil. There are several grades, sold as red, white, blue, green and yellow seal. The green seal brand is regarded as being the best; it consists of zinc sulphide, 30 per cent.; zinc oxide, 2 per cent., and barytes, 68 per cent. The other grades range from 26 per cent. zinc sulphide to about 14 per cent. If you will drop a little diluted hydrochloric acid on some zinc white there will be no result. But drop it on lithopone and you get the odor of a burning match, or sulphuretted hydrogen. It will also effervesce. Lithopone has good covering power, spreading well, but is not to

be used in connection with white lead, which it discolors. Of itself it is a very permanent pigment, being unaffected by sulphur gases or other gases that are baneful to many other pigments. Its greatest use as regards house painting is in wall paints, a subject treated in full in another part of this work. It has long been used as a paint by oil cloth makers.

White Lead.—Corroded lead, basic lead carbonate. May be made by several different methods. Is an amorphous white powder, with little affinity for linseed oil, an elastic base, and the best for all general paint purposes. Should be white, fine, and of good covering power. A yellow tone indicates overheating while grinding. Of a pink cast, contains some red lead. A grayish tone indicates the presence of uncorroded lead.

Sublimed Lead, or basic lead sulphate. It is made by burning lead ore that contains some zinc and which cannot be entirely removed. There is found usually about 90 per cent. lead sulphate and 10 per cent. zinc oxide in its average composition. It has a harsh texture, and is not as elastic as the best white lead, nor has it as good a covering power. It does not flow well under the brush, nor make a nice, level surface. Exposed to sulphur gases it will not darken as white lead does. The addition of a small percentage of Paris whiting is said to greatly improve its texture. In fine, it has so many objectionable qualities that it cannot be said that it is a useful pigment for the house painter. It does not present any advantages that white lead does not offer, while its merits are few. Under the blow pipe it is difficult of reduction and can only be reduced when fused with

powdered borax, and even then with difficulty. Its critics say of it that it lacks body, becomes brittle, and cracks.

Zinc Lead.—This rather modern paint base, used mostly by paint manufacturers, is composed of about equal parts of lead sulphate and zinc oxide, and is derived from an ore containing lead and zinc. The method of making this pigment is similar to that employed in making sublimed lead. Possessing a good body, yet it does not work as well under the brush as a mixture of lead and zinc in equal parts. It has a harsh texture, more than that of sublimed lead, and its color is poor. It, however, carries more oil than either white lead or sublimed lead, by about 20 per cent. Used by itself on exterior work it shows a tendency to crack.

Sulphate of lead, largely used in some ready made paints, lacks covering power, a fault that may be overcome by the addition of borax, it is said. Lead sulphate is not poisonous, nor is borax.

Steatite.—The mineral steatite is better known to the public as soapstone, talc or talcum. It is a composition of magnesium oxide and silica, combined with a certain percentage of water. Most people are familiar with the substance, and will recall its soapy feel, it being a favorite foot powder, to enable one to draw on one's shoe easily. Also, as talcum powder. But there are several varieties, and several colors, such as white, cream, gray and pale apple green. To the variety which is scientifically described as foliaceous, or micaceous, is given the name of talc. To the compact, crypto-crystalline to coarsely granular forms is given the name steatic. To the dark gray and greenish talcose rocks, which are soft enough

to be cut by a knife, and which have the peculiar soapy feel, is given the name soapstone. The pure creamy white talc is used for making crayons and slate pencils. French chalk, used by tailors, and often mentioned by sign painters as useful for outlining letters on glass, is a very fine talc, obtained from abroad; most, if not all of what we use, being quarried in our own country. The fibrous and granular talcs are used for a number of purposes. One very near relation of talc is meerschaum, the chemical formulas of the two being very alike, both being composed of magnesium oxide and silica, with a little water. Soapstone in powdered form is used in quite a number of special paints, but is too transparent in oil to be used as a base. Its chief value lies in its property of giving a glaze or polish to a painted surface, to its fireproof character, and its voluminous nature.—*Scott.*

WHITING.—Whiting is made from natural chalk rock, which is crushed to a coarse powder, then is ground under water to a fine pulp, after which it is ground in another kind of mill, and made into a moist cream. Then the cream is run into a large tank of water, where it is stirred, and after a time it is allowed to settle, the coarser parts going to the bottom, and the liquid part is drawn off into another tank, from whence it is run into a still smaller tank, each time losing something of its coarseness. This washing process is called "levigation." By this system of "floating" the whiting in water the last tank will contain the finest whiting, and the different tanks will yield different grades of whiting. The whiting is now taken from the tanks in a moist mass and dried in a "stove room." The whiting may be sold in this lump form. When moulded in cylinder form it is called

Spanish white. This hard lump whiting must be ground in mills before it is fit for the decorator's use. Ground, then sifted through what is called "bolting cloth," a fine-meshed textile material used also by millers of flour. The resultant whiting is known as bolted whiting. But much of the "bolted" whiting on the market is really "air floated" whiting, a much finer substance.

When the whiting settles in the tanks the coarsest part goes to the bottom, the next coarsest part forms a layer upon the first, and so on, the top layer being the lightest and finest. This top layer is known as Paris white, the layer below is called "gilders' whiting," and the bottom layer is sold as "commercial" whiting, it being used mostly in the manufacture of putty.

The name of whiting in chemistry is *calcium carbonate,* meaning carbonate of lime.

While whiting is usually classed among the inert pigments by paint men, yet it is well known as a form of lime, being a carbonate of lime, it must form a lime soap by reason of a chemical reaction between it and the oil in paint. Such a paint, that is, whiting in oil, or a paint in which whiting may largely figure, cannot be considered a durable one. Yet we have the evidence of great durability in the well-known form of putty, which, when properly made, becomes hard as stone, and does not soon decay. Also we know that a white paint containing some whiting with lead, was formerly used for years, and with the best results, on river boats. At any rate, whiting is one of the most indispensable materials we use.

The different grades of whiting vary in weight, the best being finest of texture, weigh less, or are bulkier. Thus, a gallon of precipitated chalk, the finest form of

chalk or whiting, weighs but little less than three lbs., while a gallon of Paris white weighs a little more than 7 lbs. A gallon of gilders' bolted whiting weighs nearly 6 lbs.

Barytes.—Certainly if ever paint makers get to worshipping graven images they should carve them out of the mineral barytes, for it has been their most useful agent in connection with the manufacture of paint and colors. Not that the use thereof has always been wrong, for as an extender or necessary filler, barytes has its use. But many a ton of it, costing, say, $20 a ton, has gone into paint shops at anywhere from $100 a ton upwards, in the form of so-called white lead, paint and colors. To-day comparatively little of this shameful adulteration is done, and when barytes is used in paints or color, some excuse is generally made for its presence. That it is a valuable addition in many cases there can be no doubt, but as an adulterant it is always wrong.

Given two samples of a white powder, one of which is dry white lead, the other dry barytes, and asked to tell the two apart you could not do it; they are equally white, equally fine, equally heavy. But rub up some of each in oil, and at once the difference is apparent, the white lead continuing white, the barytes looking like putty.

Being exceedingly fine of texture, free from color, and inert, it has paint virtues of a high order. It takes stains uniformly, and to make a small quantity of color, aniline, for instance, cover much surface, it is very useful; it is in, consequence, used as a base for conveying many organic coloring matters that are used in paints.

In the paint shop barytes has no place, whiting being the more useful inert material to the painter.

WHITE LEAD

HILE I have endeavored as far as possible, in the preparation of this work, to refrain from discussing paint from the chemist's position, yet it is necessary to say a little about the chemistry side, too. Thus, to describe white lead without telling of its chemical make-up, would be of little use, since there are many forms of white lead, some of little value to the painter, others not satisfactory, and the remainder excellent. Now, we want to know why this is, why "good white lead will not differ materially in its composition by whatever process it is made, but may differ seriously in its physical character, and in its fitness to produce a substance adapted to the uses to which white lead is applied." Good white lead may be a compound of two kinds, one containing two molecules of carbonate, the other three molecules. Or, one part of hydrate and two parts of carbonate of lead, and one part hydrate and three parts carbonate of lead. The latter is in the proportion of 75 per cent. carbonate and 25 per cent. hydrate of lead, and this is generally accepted as the correct formula of a good white lead. This seems trifling, yet when we come to understand the subject we find that it is very important. The chemist tells us that the hydrate of lead and the linseed oil in the ground lead unite to form a sort of varnish, it is semi-transparent, and has no covering capacity. But it holds the particles of lead together, a very useful matter. Now, the carbonate of lead and oil produce an opaque compound, which has no body or covering, and in which the white solid carbonate is held in feeble mechanical suspension. Neither,

alone, is a paint, but united they form the best paint material known. Now, the proportions of hydrate and carbonate should never exceed or fall below these figures. Yet it will readily occur to you that such a variation might easily occur, doubtless does so occur, and we have some white lead that is not as satisfactory as others..

Little needs be said about white leads made by different processes. No method of making white lead may be considered entirely satisfactory, the ideal way is yet to be discovered; but we get very fair results from any white lead that is worthy of the name, and with this we must rest content.

There are two points desirable, whiteness and fineness. Whiteness indicates perfect corrosion and the absence of impurities and discolorations. The whiter the lead the clearer the tints and whiter the white job. A painter will almost invariably pick out the whitest white lead when offered two different brands. And if it turns out gritty or so-called sandy, he wants no more of that.

There are extremes of color to guard against, the blue tint and the yellow-toned lead. The blue is artificial, and the yellow shows a burnt lead or the presence of foreign matter, due to poor methods of manufacture.

A finely-ground white lead means more wear and tear of grinding machinery, and less output per hour, too. And it takes more oil, also, oil being a costly ingredient. The grinder saves time and machinery and money by not grinding fine, which means also that his product will be thinner than it should be. He loses something in this matter of thin grinding, too, for it takes more oil, yet it pays better than the stiffer and finer grinding.

Careful grinding is required in the making of a good white lead. Too close grinding or friction will result in the graying of the product. A first-class white lead will show perfect whiteness, it will be opaque, or perfectly non-transparent, free from acid, free from water, and free from every foreign matter. Overheating of the mill will make a white lead more or less deficient in body, due to too great saponification of the lead and oil.

In the making of white lead only the purest lead should be used; it must not contain more than the merest traces of copper, iron, zinc, or bismuth, or antimony, and not an ounce of silver to the ton of lead, the chemist tells us. All these minerals appear in close association with lead. If they exist in excess of this very small proportion they will show in a low percentage of corrosion and defective color of the finished product.

One of the best points with white lead is, that having added enough linseed oil to it to overcome its chemical reaction, sufficient body is left to satisfactorily hide the surface and afford the desired degree of opacity and whiteness. White lead is perfectly stable in pure air, and is not affected by light. In impure air, however, it is not permanent, being rapidly decomposed by even weak acids, and gradually changing color on exposure to air containing hydrogen sulphide or other sulphur compounds, turning first yellow and finally a dingy brown, owing to the formation of lead sulphide. This discoloration is less rapid in oil paint than in water colors, because of the oil film protecting it; yet the yellowing occurs in time. This discoloration is accelerated by darkness and retarded by sunlight. The sun, indeed, bleaches white paint in the open air. Thus we may take a board that

has been painted with white oil paint and left in the dark for a long time, and set it in the sunlight for several days, when the original white color will be more or less restored, this being due to the fact that the lead sulphide has been oxidized to lead sulphate. Therefore, white paint in oil does very well on exterior work, as the sun bleaches out the oil, and the whiteness will be more or less unimpaired, according to the amount of sulphur gases in the air, as where there is much soft or hard coal gas. It is also best to use little or no driers in outside white paint, because driers hasten the drying, and this is only another way of burning the paint; you know that when you overheat white paint it yellows or browns, according to the degree of heat employed. Hasty drying of the white paint, therefore, tends to darken it.

White lead is easy of adulteration, and frequently is found adulterated. Some samples of white lead were found to contain absolutely no white lead at all. The pigment mostly used for the purpose is barytes, because it is most like white lead in specific gravity; if whiting, or similar pigment of low specific gravity were used, it would soon be detected. Pulp white lead is simply that which has been ground in water, forming a pulp that weighs 12 to 20 pounds to the gallon; to this pulp is added the necessary amount of linseed oil; it is then churned much as butter is churned, and in a little while the lead and oil will unite and fall to the bottom, while the water rises to the top and is drawn off. The lead is then packed in kegs. Pulp lead is not considered desirable by most painters. That some water remains in it seems more than likely.

It is advised that the painter test his white lead, thus, for one simple way: Take a very small quantity of the white lead and place it in a saucer, then pour over

it some turpentine and mix to about the consistency of cream. Pour this mixture rapidly on a piece of glass and allow it to drain off, when, any grit being present, the same may easily be detected.

Old white lead is usually regarded as being better than the freshly made.

White lead and linseed oil mixed in almost any common proportions of vehicle and pigment give a paint which is readily workable, of good hiding power, and which, after application, produces an elastic paint film, that because of its elasticity, will resist the destructive agencies of the weather better than any other paint. It possesses the ability to contract and expand in response to the seasonal temperature changes without either losing its tenacious grip upon the surface it is protecting or developing cracks and checking because of brittleness.

Some painters contend that the addition of some color to white lead paint adds to its durability, but I think this is not true in the way they think it is. It is not the color or added pigment, but the fact that more oil is required and added. White paint apparently does not cover as well as, say, a gray, made by adding four ounces of lampblack to one hundred pounds of white lead. The gray seems to cover better than the white, hence we feel safe in thinning it out more, and in that way get more oil and greater durability.

White lead becomes rather solid with age, especially in a wooden container, in which case the oil is largely absorbed by the wood, and in any case the oil rises to the top and leaves the heavier lead solid at the bottom. It is true that soft lead is easier to mix, but if very soft in the keg and it may be regarded as being fresh,

and hence not as good for painting with as a lead having some age.

Danger from White Lead.—The danger to be apprehended by painters in the use of white lead is grossly exaggerated. Those who work where the lead is made, and where there is much dry white lead or dust, are, indeed, liable to poisoning, but once the lead is mixed with oil, the danger of poisoning is next to none at all.

The following is regarded as a trustworthy and simple commercial test of the purity of white lead: Take a piece of firm, close-grained charcoal, and near one end of it scoop out a cavity about half an inch in diameter and a quarter of an inch in depth. Place in the cavity a sample of the lead to be tested, about the size of a small pea, and apply to it continuously the blue or hottest part of the flame of the blow pipe; if the sample is strictly pure it will, in a very short time, say in two minutes, be reduced to metallic lead; but if adulterated, even to the extent of 10 per cent. only with oxide of zinc, sulphate of baryta, silica, whiting, or any other carbonate of lime (which substances are the only adulterants used), or if it is composed entirely of these materials, as is sometimes the case with cheap lead (so called), it cannot be reduced, but remains on the charcoal an infusible mass. Dry white lead (carbonate of lead) is composed of metallic lead, oxygen, and carbonic acid, and when ground with linseed oil, forms the white lead of commerce. When it is subjected to the above treatment the oil is first burned off, then at a certain degree of heat, the oxygen and carbonic acid are set free, leaving only the metallic lead from which it was manufactured.

If, however, there be present in the sample any of the above-mentioned adulterations, they cannot, of course, be reduced to metallic lead, and cannot be reduced by any heat of the blow-pipe flame to their own metallic base, and being intimately incorporated with the carbonate of lead, they prevent it from being reduced.

Why White Lead Paint Chalks.—This is one of the many paint troubles that in former years was unknown. As long as the linseed oil and white lead remain in the original condition, as a paint, there will be no chalking, of course, for chalking indicates the loss of the oil. Various reasons have been given by experts why white lead paint so often chalks, as compared with olden times. Probably there is much truth in that which ascribes the trouble as being due to insufficient coats and hurried work. Years ago, not less than three coats were given to new work, while now two is the rule. Then, time was taken to brush out the paint and rub it in well. Now, the paint is fairly dashed on, with no pretense to doing a strictly first-class job. Again, in the old days, say before the Civil War, thin coats were applied, while now two heavy coats are made to do the duty of three in hiding the wood and giving a fair surface. It was no unusual thing to find exterior painting in good condition after twenty years of exposure and wear. Now, it begins to deteriorate in a year. Yet we know of cases where, three thin coats being given and the paint well rubbed out, as in the old days, at least seven years of wear are obtained.

A white lead manufacturer has published a treatise on the subject, from which we will quote liberally, for we think he has come near the core of the whole matter. He claims that enough oil is not used in

paint. He cites the case of a master painter who mixes his white lead paint and lets it stand 48 hours before using, and then he adds another gallon or two of oil to the batch of 100 pounds of lead mixed paint. He claims that he has never had a complaint of chalking, the extra oil added giving extra durability. To quote from our white lead maker's treatise:

"When too little oil is used the lead particles are insufficiently clothed or protected from the weather, and having no weather-resisting properties of themselves, they must of necessity become loosened from the surface when the insufficient quantity of oil has disappeared.

It is the natural conclusion—that the durability of any paint is dependent on providing enough linseed oil to thoroughly protect the paint pigments from the weather.

Linseed oil is peculiar inasmuch as all coats of lead, although each one may have been thinned with a different quality of linseed oil, will, shortly after the painting is completed, hold together and form one compact paint mass—of a general average quantity of oil. The pigment of the coat remains fixed—but the oil penetrates and permeates the whole mass by capillary attraction until equilibrium is established.

In other words, if the surface be uniform, the oil naturally diffuses itself regularly and in exactly equal proportions throughout all the new coats of paint applied to the surface, making practically one heavy, solid paint coat.

Therefore, if the original surface absorbs too large a proportion of the oil used in mixing the paint, or if any succeeding coat is deficient in oil, the paint mass is robbed as a whole, and not each coat separately.

And further, if too little oil is used for priming, or any other coat, there must of necessity be too little linseed oil in the exposed paint surface, and consequent chalking.

Please remember it is that part of the paint mass that is directly exposed to the weather, that should, and must of necessity, have the requisite, and if it were possible, the largest proportion of linseed oil."

A painter said: "I painted that house when it was new, applying three coats outside, and it lasted for about seven years. The owner was so well pleased with the job that he had me to re-paint it, and while I used the same materials as in the first job, and did the work just as good, yet he is now complaining of the chalking of the lead." The trouble was easily explained. When the work was new the priming coat was mostly oil, and the two finishing coats contained plenty of oil. But, when the job was repainted, two rather heavy coats were given in order to make a nice job, with the effect that the oil that should have remained with the last two coats, and more particularly the last coat, was sucked out into the old paint, and hence the chalking. The same thing occurred with a painter who had a church to repaint on the outside. In order to fulfil the expectations of the parties giving him the job, he put on three heavy coats of paint.

This also explains why so often a painter who secures a contract at a low figure gets a lasting effect. His materials are the costly item with him, particularly where he does most of the work, as many small contractors do, and hence he saves on lead and thins out well with oil, for this saves lead and time, too, for he can spread the oil quicker than the lead.

"Unless the surface to be painted is very dark, a thin coat, long in oil, and a medium heavy second coating, will give just as satisfactory a result, and far greater durability, as two very heavy coatings. If the surface is very dark, or very porous, three coats are necessary, that you may get the necessary hiding power without sacrificing the necessary linseed oil."

"It is strange, yet true, that, with high-class painters, those jobs go wrong on which the painter earnestly strives to do his best work, and when, as a rule, no price is asked, and the cause is almost invariably that in trying to do his best work, he does his worst, inasmuch as he puts too much lead value on to his work, rather than too much linseed oil value.

"Linseed oil is cheaper than white lead. Take 100 lbs. white lead of best grade ground in pure raw linseed oil, and which bulks 2 8-10 gals., and $5\frac{1}{2}$ gals. of thinners, the whole amounting to $8\frac{1}{4}$ gals. of paint. Say the white lead costs $8.00 per 100 lbs., and bulking 2 8-10 gals. as stated, the actual cost of a gallon of the thick white lead in oil by itself is $2.85, before being thinned for use. Therefore, linseed oil, even at $1.25 a gallon, costs less than half of the bulk cost of thick white lead in oil, and the more oil you use the more economical and desirable the paint."

This is the argument of a large white lead manufacturer, and while it may sound as if he would boost oil and put a damper on the use of white lead, yet it is clear, or should be, to any one, that what he wants to impress upon us is, that white lead will have its proper recognition as a paint base if it can be shown that chalking is not an inherent fault of the lead. He further argues that the fact that there is a chemical compound formed when white lead and linseed oil are mixed, yet the fact has little if anything to do

with its chalking. Here it might be said that some chemists say that this chemical action results in soap making, something akin to what we see when we add lye to fat. Becoming soap, the paint is easily acted upon by the weather, and soon chalks. This our white lead manufacturer disputes; not that the soap does not occur, but that if it were true, then "the paint mass would disintegrate as a whole, where as a matter of fact, the paint mass does not disintegrate at all."

"The only action is, that light, heat, rain, etc., disintegrate the linseed oil of the paint mass, on the exposed surface, and the moment the oil is gone, the lead becomes 'chalky.' There is nothing to bind it, and the above contention is proven, inasmuch as the remainder of the paint mass remains absolutely unaffected.

Of course, as successive exposures of surface are attacked in turn, the linseed oil becomes disintegrated gradually, until the oil has entirely disappeared, and leaving no binder to the surface to hold the lead, it all 'chalks' off in time, but the time required is several years if the proper amount of linseed oil has been used."

Is white lead as good as it was years ago? This question is usually answered in the negative by painters, certainly by "old timers." Yet some say it is better now than ever before, the refining of the metal lead is more perfectly done, corrosion is exactly the same, at least, with Dutch process leads, and new and improved machinery and electrical appliances enable the corroder to reach a higher physical perfection than ever before. I have read somewhere that the old-time lead, even the much-vaunted English BB lead, always contained a certain percentage of barytes, and that is why it was superior to the really

pure lead of to-day. I have no means for ascertaining whether this is true or not.

Is the linseed oil as good as formerly? Another much-discussed question, but one that we will not discuss in this connection.

Now, coming back to the matter of lead soap. White lead and linseed oil form a certain kind of soap, as previously stated, but this lead soap is claimed by our white lead man to be insoluble in water. If this is true, then it is not the kind of soap we are familiar with. Indeed, it cannot be soap at all, or, at most, has few attributes that are found in common with soaps.

It is also said by some authorities that hydrate of lead, which is a component part of all Dutch process leads, "eats up" the oil and causes chalking, but this our white lead man denies, and he adds:

"As evidenced, note the report of the fence tests, proving that oxi-sulphates of lead, made by the heat process, and other soft-drying paint pigments, none of which contain a particle of lead hydrates, show as great, if not greater chalking propensity than the hydro-carbonate of lead itself."

Finally, and to sum up, it is probable at least that if we get back to the old-time practice of using plenty of oil with our lead, apply thin coats and enough of them, getting and using good materials, we shall have no further difficulty with our paint made of white lead and oil chalking. Of course, there are many factors entering into the problem of good painting, such as present day lumber, for example, and the possibility of bad oil, but, with care and the getting of as good materials as we can, our painting will compare very favorably with that done two generations ago.

ZINC WHITE

ELECTION.—This is a point which must not be overlooked, as there are marked differences in the quality of zinc paints, just as in other products in the paint trade. Among the points which the purchaser ought to look to in selecting a zinc paint may be mentioned color, fineness of grinding, opacity, capacity to mix readily with thinners. These are all properties which can be readily determined and compared by careful examination of the sample alongside a previously selected standard. Inferior zinc paints will always compare unfavorably in regard to one or probably several of these points. Thus bad color and "grayness" may be masked by the addition of blue, a sophistication which can easily be detected. Again, inferior grades of oxide zinc are transparent, or in other words, possess low opacity. The addition of barytes as an adulterant to the paints causes the same fault. It should be noted in this connection that certain zinc pigments contain barium sulphate as an essential part of their composition. This material differs in its physical properties from the native barytes, so that the mere presence of barium sulphate in a white zinc paint does not condemn that paint, as can be proved by accurately determining the opacity-figure of pure sulphide zinc white of a reliable brand, and comparing it with that of white lead. To prevent all ambiguity on this point, however, it is preferable to divide zinc white paints into oxide of zinc paints (which should always be absolutely genuine) and sul-

phide zinc paints (the pigment in which should contain not less than 30 per cent. of true zinc sulphide).

Fineness of grinding is a point which should always be looked closely into by the painter, as some paint grinders are very careless on this score. Zinc paints are by no means easy to grind with oil, and there is occasionally a temptation to gloss over any little imperfection in the grinding by the addition of pale boiled oil or an artifically prepared thickened linseed oil. The painter can always detect such dodges by thinning the paint out with pure turpentine and painting a glass slip with the mixture by means of a clean camel hair brush.

The variations in the ease with which the different zinc paints "take the thinners" is remarkable. A well-ground sample of zinc white of good quality ought to be no more difficult to mix with the thinners than good white lead. Occasionally, however, one finds a zinc white paint which is stringy and ropy, and this is a serious defect.

The conclusion I have come to, after examination of a very large number of samples of zinc paints, is that although paint grinders may for reasons of their own sometimes employ pale boiled or thickened oils in the grinding of white zinc paints, the painter is best served when his stiff paint—the base to which he has to add his thinners—contains no vehicle but pure, refined linseed oil.

The question of the proper consistency of the stiff paint is so well understood on the continent, where zinc paints are handled every day by painters, that on large contracts architects and engineers are in the habit of specifying the exact composition of the stiff paint. Thus, a certain large industrial undertaking in Belgium using quantities of zinc paints, has its

ground zinc white (Blanc de zinc broye) of the following composition: Oxide of zinc in powder, 666 parts by weight; linseed oil, 334 parts by weight.

In another case the stiff zinc paint (oxide of zinc) is specified to contain 20 per cent. of linseed oil. Paint of this composition is readily mixed with oil or turps. It is a great mistake to grind zinc paints too stiff. If the paint is too viscuous on the rollers of the grinding mill it is readily overheated and burned, and this at once ruins the paint.

THINNING ZINC PAINTS.—This process is a vital one, and deserves special attention from those who wish to obtain the most satisfactory results. It is best carried out by mixing the thinners and driers together first of all, and then adding the mixture to the stiff paint. By proceeding in this way, uniform results are much more likely to be obtained. The first thing to do is to fix once and for all the relative proportion of oil and turps that should be used for different kinds of work. The following are proportions which have worked out practically and which may be adopted:

	1	2	3
Refined linseed oil	11 pints	12 pints	4 pints
Turpentine	3 pints	4 pints	24 pints
Mixed varnish	1 pint	1 pint	1 pint

No. 1 is suitable for exterior work. The mixing varnish should be a good outside varnish. For finishing coats, where the maximum of durability is desired, pale boiled oil may be substituted for refined linseed oil, and the proportion of turpentine reduced to two pints, one pint, or even less.

No. 2 indicates a mixing suitable for a glossy finish in interior work. Here the mixing varnish should be a hard-drying interior varnish.

No. 3 is suitable for flatting or undercoat for enamel. In this case either a flat mixing varnish or gold size should be used.

There are three practical points worthy of attention in connection with the mixing of zinc paints. They are:

(1) Do not use too large a proportion of turps. (This does not, of course, apply to flatting.)

(2) Keep the paint "round;" the best zinc paints are those that are somewhat viscuous, and they brush out, as a rule, quite easily.

(3) Do not try to force the drying unduly. The drying of all paints depends on the action of the air on the drying oil. Driers are therefore at the best an artificial aid to drying. The most durable paints are those in which the drying proceeds slowly, naturally and regularly.

Driers for Zinc Paints.—This question is also a vital one, and deserves special attention from those who wish to obtain the most satisfactory results. The old-fashioned paste or patent driers are most decidedly not the most satisfactory driers for zinc paints, and as this question is continually cropping up, and painters frequently find that driers are the stumbling block when zinc paints are in question, I may be allowed to digress for a moment to indicate why paste driers are not, as a rule, successful in zinc paints.

White lead is itself a "drier," and consequently the addition of more drier results in a strong drying action rapidly setting in. When this drying action goes too far, as it often does, the oil gets burnt up and the paint powders and perishes. This phenomenon is often seen in old white lead paint. Now in the case of zinc white paints, which are absolutely inert so

far as drying action is concerned, the drier (whatever it be) must first be brought into solution in the oil before it can exert any drying action. Paste driers in which the drying material is mainly in the solid state, take some time to dissolve in the oil contained in the mixed paint, and there being nothing present of a gentle drying nature, like white lead, to start the drying off, so to speak, the action takes some time to begin. This constitutes a danger, as the ignorant man then adds more driers, until there is a huge excess of drying matter present, resulting in serious damage to the life of the paint.

The use of liquid driers is preferable. In these driers the drying matter is already in the liquid state, and is therefore in a condition in which it can much more quickly and effectively enable the drying process to commence. Further, liquid driers, when of good quality and used in strict moderation, contain nothing injurious to the paint. The true role of a paint drier is often misunderstood. It is to start the absorption of oxygen by the drying oil, and to keep the absorption going regularly and moderately. If this is done, a tough, durable film is obtained. Nature has been assisted to do her work. If too much drier has been used the oil will have been super-oxidized, with the result that a brittle, easily-destroyed oil film has been produced.

Mixing and Application.—To secure the full intrinsic value of zinc oxide paint it should be applied exactly as a good painter would do it, namely, in two or three or more coats, for it is a pigment that does not permit of making one coat do the work of two.

Zinc paint should be mixed rather stout but be rubbed out thin; if mixed thin it will run and not cover

properly. Properly mixed, it has been found that three coats will cover as much surface as three coats of white lead paint, and cover the surface just as well.

In mixing zinc paint there should be used a suitably prepared linseed oil, and should contain very little turpentine. Being a poor drier, it should be well assisted with driers. The addition of a little varnish in outside zinc paint is advised.

When used for making a flat or dead finish, it must be remembered that zinc white ground in oil contains a larger percentage of oil than white lead, as it takes up much more. This oil must be removed with washes of benzine, in the usual manner; after which the pasty residue may be mixed with turpentine and a good flat paint result. Zinc white contains about 20 per cent. oil in the paste form, while white lead contains only about eight per cent.

Some painters advocate zinc for priming coats on wood, but this may seriously be combated, white lead being in every respect the best pigment material for that purpose.

The priming coat being white lead, then let the next two, say, be zinc paint. Or three coats of zinc may be used, according to the quality of the work. Let each coat be mixed somewhat different from its neighbor coat. Do this by varying the quantity of oil, etc. This is the rule in all good painting.

Pale boiled linseed oil is a good medium for thinning white zinc paints, but boiled oil is always difficult of admixture with zinc, when the mixing is done with a paddle; with machinery, as in the paint factory, the case is different. Yet if a pale drying oil can be used for thinning zinc paint it will be found very much better than ordinary raw oil.

For many purposes the oxide of zinc as ground already contains sufficient oil, and only needs to be thinned down to the proper consistency with turpentine.

For painting on a non-porous surface, like iron, for instance, no oil need be added, and a beautiful white enamel surface will ensue, with an egg-shell gloss. The 20 per cent. of oil in the zinc paste will be quite enough to give this effect. Most of the troubles with paint come from bad oil, which is the most important factor of the two, oil and base.

Preparation and Use of Zinc Oxide

Out of the mass of controversial matter respecting the merits of white lead and zinc for exterior painting it is well to avoid extremes in either direction. A combination of these two important pigments has proven its worth, consisting of three parts of pure white lead in oil and one part zinc. In this proportion the zinc holds the lead from chalking and the lead holds the zinc from chipping and fissuring. Mix the pigments separately in the proper liquids, and at the right consistency pour together and stir until a complete incorporation of the two bodies is obtained. Used in coats, above the priming, this combination is rewarding the user with very durable results in both eastern and western sections of the country.

If you buy it ready ground in oil, you will require per hundred weight about two gallons of pale boiled linseed oil and not more than three-fourths of turpentine to thin it out to the proper state fit for application.

"In practice I have found that French zinc will often overcome many of the troubles caused by the

modern mode of plastering. By applying two coats of zinc, ground in poppy oil, to the walls, a foundation is made for the final coats of lead, which completely overcomes the minor troubles caused by the use of patent plasters."—*Correspondent.*

For the first coat, zinc and all pigments possessing great tenacity in their particles, should be avoided, for they will surely peel clean to the wood or other surface when the oil decays. For after coats it is all right.

Poppy seed oil is largely used in the mixing of zinc pigments, but linseed oil is also used, and is better than the former, as it is a better drier.

We have known of painters having trouble mixing lead and zinc together, but it was because they did not go about it right. If you mix the lead, and then try to add the zinc to it, there will be trouble. Try mixing the two separately, and then slowly add one to the other.

A good way to mix the two is to "box" them, that is to pour alternately one bucket of paint into the other.

Do not mix white zinc paint too thin, which will cause it to apparently have no body. Apply rather thick and spread out under the brush.

Zinc white paint for outside use should be mixed with pale oil, and be made thick, or heavier than white lead and be applied thicker than lead paint, but well brushed out.

If you will mix the zinc, say a day before using it, you will find it will work and cover better.

In using zinc it is well to use a stopping of putty made of the same material. Zinc white putty is made by adding finely ground Paris white to the paste zinc. It must first be passed through a fine sieve so as to

eliminate all grit or lumps, and well kneaded into the stiff zinc ground in oil.

Zinc white being an artificial product its composition varies, the best grades approximating 10 per cent. zinc oxide, while some of the cheaper products contain more or less lead compounds, either as sulphates or oxides, and possibly sulphate of zinc, which is considered harmful, as it is soluble in water, and is liable to make the paint streak. Zinc oxide is rarely adulterated.

MIXING COLORS

OLOR mixing requires full experience with the different pigments employed in painting and "an eye" for color, too, so that when any different shade is to be made or one shade to be matched with another mixing, a perfect shade, tint or color will be obtained. The pigments used by the house painter are not many, and they differ so widely in color that their identification is easy. The list is as follows, taking the pigments in the order of their most general using: Yellow ochre, burnt umber, raw umber, burnt sienna, raw sienna, lampblack, chrome yellow, Vandyke brown, Prussian blue, drop black, red, and chrome green.

The expert painter can do without a few of these pigments, if necessary. For instance, he can make a Vandyke brown from black and burnt umber. Or make a green from yellow and blue, any desired shade. He may even approximate black by mixing certain proportions of red and blue together. But it may be said that such expedients are never necessary, or very rarely so, though it is well to know how to do the thing if ever in a position where it must be done.

The list of pigments given must be supplemented with an explanation. For instance, there are of black, drop and lampblack; of blue, there are Chinese, Prussian and ultramarine; of green, chrome, light, medium and dark; of red, Indian, Venetian, Tuscan and turkey. With the reds we may include the vermilions, of which there are several kinds, the principal ones being English, American and Chinese. The list of

vermilion includes also a large number of special kinds, each factory putting out its own special brand, and these are not worth considering here, being mostly used in wagon painting. They are usually made from a lead oxide tinted with eosine dye.

Of yellow there are light, medium, orange, and D. and DD. The orange chrome may be classed as a red, for its tints are decidedly reddish, or orange, which is a combination of red and yellow, the red very prominent. Chrome, light shade, is also called lemon yellow.

The expert painter understands the value or color possibilities of each of these pigments, and hence knows what to use when desiring to produce a certain color. His pallette is small, but it answers every demand that can be made upon him for his work. He knows, for instance, that to produce a drab he must use umber and white, or lead color, black and white, and so on. All of which will be explained in detail, for the benefit of many who are not expert color mixers—and many a good painter knows next to nothing about color mixing, because never having been called upon to mix paints or colors, this being particularly true of jours. The writer has had a jour. to ask him how lead color was produced, and he was a good paint brush hand, too.

In mixing color we cannot use weights or measures, as pigments vary so in color or tinting strength, hence we must depend upon the eye alone, in connection with our knowledge of colors and their values. While a good color mixer may do well without the slightest knowledge of color science, yet it is advised that the painter make himself familiar with at least the fundamental principles of that science. It is well to know what the primaries are, namely, that they are

red, yellow and blue. That from these all other known colors may be produced. That when we mix red and yellow we get orange, or blue and yellow, we get green, and so on, all of which is explained under an appropriate head. Familiar with the primaries, secondaries and tertiaries, one may avail himself of an infinite variety of colors, tints or shades. I would impress upon the learner that he study this color science as laid down in this work, sensible that it will repay him a thousandfold. Almost anyone may mix a pot of paint that will answer its purpose with more or less efficiency, but to mix colors is another thing entirely.

In connection with knowing how to handle the colors, we must also understand the nature or possibilities and limitations of the bases we employ usually in connection with the pigments. For instance, white lead must not be mixed with any pigment containing sulphur, such, for instance, as quicksilver vermilion or lithopone. But zinc white may be used in connection with practically any pigment the painter may use.

It is perfectly neutral or without chemical influence on other pigments. This is true, too, of sublimed white lead, though perhaps in a less marked degree, zinc white being chosen in its stead in most cases as being finer. But most of the colors or pigments used by the house painter may be safely used with white lead or other base. That is, all earth pigments are neutral, while the chemically prepared pigments are apt to act badly with certain bases, such as white lead, for example. All of which will be fully explained under a proper head.

There are some colors called for occasionally that are outside of the regular list, and these bother even some good mixers, owing to their being out of the

usual. We give a few of them in this connection, though all will be found in the list given elsewhere.

PULLMAN COLOR.—This is familiar enough to the car painter, but the house painter has also been called upon to use it at times. The name comes from the Pullman cars, on which the color was first employed. It is a sort of bronze green of more or less depth. Each railroad using this popular color has its own formula, hence shades vary. But the basis of all Pullman colors is ivory black, this being modified with medium shade of chrome yellow, or orange chrome yellow, or both, and a small amount of Tuscan red. In some formulas the best grade of French ochre takes the place of the chrome yellow, while the best Italian burnt sienna may take the place of the Tuscan red. Some samples have been found to contain a percentage of white lead, but such a formula would give a rather flat color. So that it will be seen that the name, Pullman color, is not a fixed or standard formula.

The colors may be in oil or in japan, as desired. First mix the colors together, taking the black first, and the following formula will serve as a guide. Take 55 parts by weight of best drop black and 20 parts by weight of chrome yellow, medium shade, and 10 parts by weight of the best Tuscan red, mix all together to form a paste, which thin, then strain. This will give you a very satisfactory Pullman color. You can use colors ground in oil or japan, according to whether the paint is to be for coach or house painting. The thinning will, of course, be with those liquids suitable for the object in view, and oil colors will require japan driers, of course.

BOTTLE GREEN.—Bottle green, for the house painter, is made from drop black, or ivory black,

Chinese blue, or Prussian blue, yellow chrome, medium shade, and French yellow ochre. We have no set formula, pigments varying so in tinting or coloring strength, hence the mixer must use his skill and judgment. In the first place there is much misconception regarding what a bottle green should be, most of such greens being entirely too dark, and many mixers and some trade journal editors and writers also, confound these two colors, bottle and bronze green, whereas, each is as distinct as are chrome green and Paris green. The true bottle green is an imitation of the color of green seen in many cheap bottles. The color of green glass in bottles varies, too, of course, but in general there is a close approach to a certain shade of green observed. A generation ago, Gardner, a carriage painter, of New York, and author of a few books on painting, gave the following directions for making a "bottle green or yellow lake green," as he termed it. He describes it as being "a very useful and at this time a very fashionable color for gears or bodies." First, prepare a perfectly solid and smooth ground and coat it with a paint made from lemon chrome yellow and black, the tone being that of green glass bottle. Japan colors are, of course, used. The bottle green finish is now made from Prussian blue, tinged with Dutch pink, until you get the true bottle green glass color. Remember that this formula is for vehicle work, though it may also be used for store or other front door work. One coat of color on a properly prepared ground should be enough. Now mix some yellow lake with hard-drying body varnish and run it through the hand mill. Next add about two tablespoonfuls of the Dutch pink color to each pint of the yellow lake glazing color, and, when the color on the job is dry, dust off and lay the yel-

low lake in the same manner as if it was color-and-varnish. This gives a deep, rich bottle green, one "that can be made in no other way." Care should be taken that no yellow, such as lemon or orange chrome, be mixed with the Dutch pink or the yellow lake, but a drop of red such as vermilion or carmine, will improve it by giving it a warmer hue.

The tone of the color may be changed so as to be suitable for both body and gears. By simply glazing the color with pure yellow lake the tone will be more yellow; by adding a drop or two of blue to the glazing color, a bluish-green will result; while a little vermilion and blue will give an olive hue. It should be added that the yellow lake is to be thinned out with turpentine.

Regarding Dutch pink, a very unfamiliar pigment with the house painter, it may be explained that it is not a pink at all, but it is rather on the yellow order. Genuine Dutch pink is of animal origin, but there is a pigment of the same name, and ordinarily used, of the same color, but in all other respects different, and not reliable. Dutch pink should not be used with white lead, but alone or mixed with certain other pigments, it is a durable color. Like Vandyke brown, another good glazing color, Dutch pink is useful for producing Spanish leather effects by glazing and scumbling.

Bronze Green.—This is not an uncommon color with painters, indeed, it is one of the very common ones, yet it is listed here in order to set the painter right on the matter of mixing names, many thinking bottle green and bronze green practically the same thing. Bottle green should contain blue, while bronze green should contain none, or at most a very little;

none would be better. To make a typical bronze green take one pound of orange chrome yellow, two pounds of medium chrome green, and nine pounds of lampblack, all in oil. Drop black may be used in place of the lampblack if desired, though the result will not be just the same, as the two blacks have different coloring properties. Also, for a lighter shade of bronze green use the medium chrome yellow, the orange chrome making a somewhat deeper color, owing to its deeper and red hue.

Bronze yellow may be made with orange chrome, medium chrome yellow, and a little burnt umber. Or with white, chrome medium anl raw umber. But all of this will be found under the head of Color Formulas, which see.

COLOR FORMULAS

Division of Reds

Armenian Red.—Venetian red 2 parts, yellow ochre 1 part.

Ashes of Roses.—Tinge pink slightly with drop black.

Brick.—Cream. White lead 400 parts, yellow ochre 32 parts, raw umber 1 part.

Brick.—Red. White lead 4 parts, Venetian red 2 parts, Indian red 1 part.

Brick.—Pressed or Philadelphia. White lead 4 parts, Venetian red 2 parts, Indian red 1 part.

Brick.—Dark. Add blue to red brick. Any brick shade, from salmon or soft fillers, to the finest pressed, dark or light, may be made by varying the proportions given, adding ochre for the salmon color brick.

Carnation.—White lead 12 parts, scarlet lake 1 part. Or, zinc white 16 parts, scarlet lake 1 part.

Cherry Red.—English vermilion 2 parts, carmine No. 40 1 part.

Coral Pink.—White lead 10 parts, vermilion 3 parts, orange chrome yellow 2 parts.

Damask Red.—Rose madder or French carmine and a very little scarlet lake or vermilion.

Geranium Pink.—Zinc white 60 parts, geranium lake 1 part.

Imperial Orange Red.—Solferino lake 4 parts, yellow lake 1 part.

Moorish Red.—Aniline vermilion 3 parts, rose pink 1 part.

Mexican Red.—Venetian red 4 parts, red lead 1 part.

Old Pink.—White, rose lake and raw umber.

Old Red.—Tuscan red, drop black and a drop of white.

Old Rose.—Tuscan red and drop black, with very little white. Or, rose madder or carmine, white, and a drop of black.

Opaque Crimson.—Carmine 2 parts, English vermilion 1 part.

Orange Vermilion.—Orange mineral.

Oriental Red.—Indian red 2 parts, red lead 1 part.

Peach Blossom.—Tint with King's yellow (orpiment, poisonous).

Pink, Opera.—White 50 parts, vermilion 5 parts, medium chrome green 1 part.

Pink, Opaque.—Equal parts of white lead and orange mineral.

Pink, Royal.—Zinc white 2 parts, carmine lake 1 part.

Pink, Shell.—White 50 parts. English vermilion 2 parts, orange chrome 1 part, burnt sienna 1 part.

Pompeian Red.—Dark Indian red and red lake, or, a good deep Tuscan red.

Rose.—Tint white with carmine.

Rose, Carnation.—Zinc white 8 parts, rose madder 1 part.

Rose, Tint.—White lead 16 parts, English rose pink 1 part; or, white 16 parts, Munich lake 1 part.

Rose, Pale Tint.—Zinc white 32 parts, Florentine lake 1 part.

Rose, Deep Tint.—Zinc white 8 parts, Victoria lake 1 part.

Rose, Royal Tint.—White 16 parts, English rose lake 1 part.

Scarlet Tint, Deep.—Vermilion 8 parts, carmine 1 part, zinc white 1 part.

Turkish Crescent Red.—Indian red 1 part, aniline vermilion 1 part, rose pink 1 part.

Tuscan Red.—Indian red 8 parts, rose pink 1 part.

Vermilion, Rich.—English vermilion 3 parts, orange mineral 1 part.

Division of Blues

Azure Blue.—Zinc white 1 part, cobalt or ultramarine blue, 1-40 part.

Electric Blue.—Mix Chinese and ultramarine blues and add a touch of red.

Gothic Blue.—Indigo blue or Chinese blue, white, and a little drop black.

Old Blue.—White, Prussian blue and a little yellow.

Peacock Blue.—White 90 parts, light chrome green 5 parts, ultramarine blue 4 parts, drop black 1 part.

Purple, Deep Tint.—White 3 parts, ultramarine blue 1 part, rose pink 1 part.

Purple Slate.—White 60 parts, ultramarine blue 3 parts, Indian red 1 part.

Purple, Regal.—White 4 parts, cobalt blue 2 parts, carmine 1 part.

Purple.—Zinc 4 parts, ultramarine blue 2 parts, carmine 1 part.

Purple, Transparent.—Cobalt blue or ultramarine blue 1 part, carmine No. 40 1 part.

Sky Blue.—White 90 parts, Prussian blue, 1 part.

Violet, Transparent.—Ultramarine blue 4 parts, orange mineral 1 part.

Violet, Tint.—White 6 parts, ultramarine blue 3 parts, English rose lake 3 parts, ivory drop black 1 part.

Violet, White.—White, vermilion, Prussian blue and lake. Or, carmine, ultramarine blue, and a trifle of drop black.

Division of Greens

Absinthe Green.—Tint white with Paris green.

Bottle Green, Oil Color.—French yellow ochre, medium chrome yellow, Prussian blue and drop black. Match color of green bottle glass.

Bottle Green, for Coach or Varnished Work.—Tinge Prussian blue with Dutch pink, and glaze with yellow lake.

Brilliant Green.—White and emerald green.

Electric Green.—Add some electric blue to chrome yellow, medium shade.

Invisible Green.—Add a very little medium chrome yellow to lampblack or drop black.

Moss Green.—Mix Prussian blue, medium chrome yellow, raw umber and white. Or, chrome yellow, raw umber and white with raw umber and white.

Olive Green, Light.—White 70 parts, ochre 15 parts, medium chrome yellow 5 parts, raw umber 6 parts, drop black 4 parts.

Olive Green.—Yellow ochre and lampblack.

Parrot Green.—Ultramarine blue, Dutch pink, and lemon chrome yellow.

Silk Green.—Mix together Prussian blue and lemon chrome yellow, and French yellow lake. As this lake is rather expensive, it may be replaced by Dutch pink.

Subdued Green.—Mix Prussian blue and lemon chrome and add a little raw umber and white to obtain the right shade. Or, add raw umber and white to medium chrome green.

Tea Green.—Raw umber, chrome green and ochre.

Willow Green.—Verdigris and white.

Division of Yellows

Acorn Yellow.—Equal parts of white lead and raw sienna.

Amber Yellow.—Medium chrome yellow 8 parts, burnt umber 5 parts, burnt sienna, 3 parts.

Aurora.—Medium chrome yellow 1 part, English vermilion 1-10 part.

Bronze Yellow.—White lead 3 parts, medium chrome yellow 5 parts, raw umber 1 part.

Canary.—White lead 80 parts, lemon chrome yellow 1 part.

Canary Yellow.—White lead 6 parts, lemon chrome yellow 1 part.

Cane.—Tint white lead with yellow ochre and modify a little with burnt umber.

Car Body Yellow.—Medium chrome yellow 1 part, yellow ochre 1 part.

Colonial Yellow.—White lead 95 parts, yellow ochre 3 parts, lemon chrome yellow 2 parts.

Cream.—White lead 98 parts, yellow ochre, 1½ parts, lemon chrome yellow ½ part.

Golden Tint.—White lead 30 parts, yellow ochre 5 parts, vermillion 1 part.

Golden Yellow.—Lemon chrome yellow 10 parts, orange chrome yellow 2 parts, white lead 5 parts.

Ivory.—White lead 98 parts, raw sienna 1 part, lemon chrome yellow 1 part.

Ivory White.—A very clear but more expensive ivory white may be made from French yellow lake 2 parts, raw Italian sienna 1 part, and 97 parts zinc white.

Old Ivory.—White lead tinted with raw sienna.

Jonquil.—Tint white lead with medium chrome yellow.

Lemon Color.—Use lemon chrome yellow.

Limestone Tint.—Tint 18 parts white lead with golden ochre 1 part.

Naples Yellow.—White lead 160 parts, golden ochre 9 parts, orange chrome yellow 1 part.

Orange, Pale.—White lead 6 parts, orange chrome yellow 1 part.

Orange, Red.—Deep orange chrome yellow.

Orange.—Orange chrome yellow, or medium chrome yellow, tinted with red.

Orange, Tint.—Equal parts of white and orange chrome yellow.

Primrose.—Medium chrome yellow.

Russet Yellow.—Orange chrome, white, and burnt sienna.

Straw.—White lead 90 parts, yellow ochre 7 parts, medium chrome yellow 3 parts; or, white 8 parts, medium chrome 1 part.

Sulphur Yellow.—Equal parts of white lead and lemon chrome yellow.

Yellow, Transparent.—Yellow lake makes the best. Dutch pink for a cheap color. Gamboge makes a bright color; or, zinc white 8 parts, yellow lake 1 part.

Yellow, Brass.—White lead 40 parts, lemon chrome yellow 12 parts, burnt umber 1 part.

Yellow, Rich.—White lead 6 parts, medium chrome yellow 1 part.

Yellow, Topaz.—White 4 parts, yellow lake 1 part.

Yellow Flesh Tint.—White 80 parts, light cadmium yellow 1 part.

Division of Buffs

Buff.—White lead 2 parts, yellow ochre 1 part.

Buff, Deep.—Tint yellow ochre with Venetian red.

Buff, Light.—Reduce yellow ochre with white.

Buff, Medium.—Add some white to ochre and tint with a little burnt sienna.

Buff, Warm.—Tint yellow ochre with Indian red.

Buff, Dull.—Add burnt umber to buff.

Buff, Transparent.—Zinc white 3 parts, golden ochre 1 part.

Buff, Rich.—White lead 2 parts, yellow ochre 1 part; or, tint orange yellow with raw sienna.

Buff, Stone.—Equal parts of white lead and yellow ochre.

Buff, Brilliant.—Use golden ochre.

Various—Unclassified

Amber.—Add a very little white to yellow lake; or, red lake and chrome yellow; or, add a little chrome yellow to carmine.

Antique Brass.—White lead 4 parts, medium chrome yellow 3 parts, Vandyke brown, 1 part.

Auburn.—Indian red, drop black and Venetian red.

Bay.—Burnt umber, Dutch pink, and Venetian red.

Beaver.—Drop black and burnt umber.

Bismarck Brown.—Burnt umber, Dutch pink, and red lake.

Brass Shade.—Yellow ochre 4 parts, Vandyke brown 1 part.

Brown.—Red and black.

Brown Pink.—White lead 16 parts, Chatemuc lake 14 parts, Vandyke brown 1 part.

Burgundy.—Asphaltum with good red lake.

Cafe au Lait.—Coffee and cream. White, burnt umber and medium chrome yellow.

Chestnut.—Tone medium chrome yellow with red and black. Or, tone yellow ochre with black and burnt umber.

Chocolate.—White and burnt umber with a little chrome yellow. Or, tone chrome yellow with red and black.

Citrine.—White lead 75 parts, yellow ochre 15 parts, burnt sienna 4 parts, drop black 6 parts.

Citron.—Tint orange chrome yellow with chrome green.

Citron Yellow.—White lead 16 parts, lemon chrome 12 parts, emerald green 1 part.

Claret.—Tinge any good purple lake or carmine with ultramarine blue. Or, tinge English purple lake with carmine.

Claret.—Tinge English purple lake with carmine.

Clay Drab.—Tint white lead with raw umber and raw sienna, with a touch of blue or green, also.

Copper Color.—White lead 20 parts, medium chrome yellow 4 parts, Venetian red 3 parts, raw umber 1 part.

Dove.—White tinted with vermilion, Prussian blue, and medium chrome yellow.

Dove Wing.—White, ultramarine, and drop black, with a tinge of red lake.

Drab.—White lead 88 parts, yellow ochre 10 parts, lampblack 2 parts.

Drab, Reddish.—White lead 90 parts, yellow ochre 8 parts, burnt umber 2 parts.

Egyptian Brown.—Asphaltum for glazing or for solid work; ivory black and burnt umber.

Electric Turquoise.—White, electric green and electric blue.

Fawn.—White lead 94 parts, yellow ochre 5 parts, burt umber 1 part.

Fawn Pink.—White lead 25 parts, burnt sienna 3 parts; or, white, drop black or raw umber, vermilion and chrome yellow.

Flax Tint.—White lead 100 parts, yellow ochre 60 parts, lampblack 1 part.

Flesh Color.—White zinc 95 parts, English vermilion 3 parts, lemon chrome yellow 2 parts.

Flesh Ochre.—Yellow ochre 31 parts, red lead 1 part.

Flesh Tint.—White lead 120 parts, yellow ochre 2 parts, Venetian red 1 part.

Freestone.—White lead 10 parts, yellow ochre 5 parts, Venetian red 1 part, lampblack ½ part. Freestone is a reddish-drab color.

Gold.—White, yellow, red and raw umber. Or, white, lemon, yellow and burnt sienna. Or, tinge yellow ochre with red and blue.

Golden Orange.—Orange mineral 2 parts, golden ochre 1 part.

Greenstone.—White lead 90 parts, medium chrome green 3 parts, raw umber 3 parts.

Gray.—White tinged with ultramarine blue, or lake, or burnt sienna and indigo. Or, with vegetable black or lake, or with Prussian blue and Indian red.

Hay Tint.—White lead 45 parts, golden ochre 15 parts, medium chrome green 2 parts.

Heliotrope.—Carmine lake and white.

Isabella.—Medium chrome yellow, burnt umber and Venetian red.

Lavendar.—Zinc white 16 parts, mauve lake 1 part, rose madder 2 parts.

Lavendar Tint.—Zinc white 80 parts, ultramarine blue 3 parts, carmine 1 part; or, white lead 48 parts, ultramarine blue 1 part, rose pink 1 part.

Lead Color.—White lead 98 parts, lampblack 2 parts.

Leather.—Tone down burnt umber and burnt sienna with white lead.

Leather, Yellow.—White lead 20 parts, golden ochre 2 parts, burt sienna 1 part.

Lilac.—White lead 96 parts, Tuscan red 3 parts, ultramarine blue 1 part; or, vermilion in place of Tuscan red.

Lilac, American.—White, red madder lake, and ultramarine blue.

Lilac, English.—White lake and Bremen blue.

Lilac, French.—White, carmine and Prussian blue.

Lilac, Rich.—Zinc white 64 parts, mauve lake 1 part, madder lake 1 part.

Lilac, Tint.—Zinc white 80 parts, ultramarine blue 1 part, carmine 40, 1 part.

Lilac, Cheap Tint.—White lead 40 parts, rose pink 1 part.

Lilac, Purple Tint.— Zinc white 16 parts, cobalt blue 1 part, carmine lake 1 part.

Limestone.—White, ochre, lampblack and Indian red.

Mahogany.—Golden ochre 5 parts, Venetian red 2 parts.

Maroon.—Carmine, medium chrome yellow, and burnt umber. Or, carmine or crimson lake and burnt umber.

Mauve.—Rose madder, ultramarine blue and white.

Mauve, Tint.—Zinc white 12 parts, cobalt blue 4 parts, carmine lake 1 part.

Morello.—Rose pink with a very little drop black and white.

Mulberry Red.—Yellow ochre, burnt sienna and white.

Old Gold.—White lead 10 parts, golden ochre 1 part, raw umber 1 part.

Olive, Golden Russet.—Lemon chrome yellow and light Venetian red or burnt sienna.

Olive, Drab.—White lead 75 parts, raw umber 13 parts, medium chrome green 7 parts, drop black 5 parts.

Olive Ochre.—French yellow ochre 7 parts, raw umber 1 part.

Orange Ochre.—Yellow ochre 7 parts, Venetian red 1 part.

Peach.—Tint white with ochre, vermilion and purple-brown.

Pearl.—White, vermilion, Prussian blue, tone with drop black.

Pearl Drab.—White, ultramarine blue, drop black, Venetian red, and yellow ochre.

Pearl Gray.—White lead 98 parts, drop black 1½ parts, Tuscan red ½ part.

Portland Stone.—Raw umber, yellow ochre, and white lead.

Plum.—White, Prussian blue, and Venetian red. Or, white ultramarine blue, red lake or carmine, and a very little drop black.

Puce.—Vandyke brown or burnt umber and drop black, with a very little yellow or ochre.

Roan.—Ivory black, red, and a little white.

Roman Ochre.—Yellow ochre 15 parts, burnt umber 1 part.

Russet.—Mix orange and purple. Or, red, blue and yellow. One of the tertiary colors.

Russet, Pure.—Orange chrome yellow 10 parts, medium chrome yellow green 1 part.

Shrimp.—White, raw sienna, with a very little vermilion.

Silver Gray.—White lead 97 parts, yellow ochre 2 parts,, lampblack 1 part.

Sorrel.—Orange chrome yellow with a very little Venetian red; or, vermilion and yellow ochre.

Silver.—White, indigo and lampblack.

Salmon.—White 36 parts, golden ochre 4 parts, English vermilion 1 part; or, white 88 parts, yellow ochre 8 parts, medium chrome yellow 2 parts, Venetian red 2 parts.

Salmon Tint.—White 60 parts, vermilion 4 parts, lemon chrome yellow 1 part.

Sandstone.—White, medium chrome yellow, and Indian red.

Slate.—Tone white with red, and darken with drop black and blue.

Snuff.—Yellow ochre and Venetian red. Or, chrome yellow, burnt sienna and Venetian red.

Spruce—White 80 parts, yellow ochre 10 parts, medium chrome yellow 6 parts, bright Venetian red 4 parts.

Stone.—White, yellow ochre, burnt umber. Or, raw sienna, burnt umber and white.

Tan.—White 90 parts, bright Venetian red 7 parts, medium chrome yellow 2 parts, lampblack 1 part.

Terra Cotta.—White 2 parts, golden ochre 1 part, burnt sienna 2 parts; or, white 85 parts, burnt sienna 15 parts.

Terra Cotta, Light.—Three parts white, 1 part raw sienna.

Terra Cotta, Red.—Equal parts of white lead and burnt sienna.

Terra Cotta, Tint.—White lead 20 parts, burnt sienna 1 part.

Tuscan Brown.—Tuscan red, chrome yellow and drop black.

Vandyke Drab.—Vandyke brown, white lead, yellow ochre and drop black.

Vellum.—Tint white with strongly boiled linseed oil.

Wine Color.—Tinge purple lake with blue.

This is by no means a complete list of colors used by painters, though a very small proportion of those given are ever used by ordinary house painters. The list might have been greatly extended and even then not contain all the so-called colors that are in use. Further, there may be some of the more familiar colors omitted, though this is not so probable. At any rate, the list will be found sufficiently full to meet all ordinary wants of house painters, if not, indeed, of interior decorators. Some of the colors listed, it may be noted in passing, are factory or color card names, but of those of this kind unlisted here, their name may be said to be legion. Also there seems to be no uniformity of color nomenclature with our

color and paint makers. and many names of colors are certainly arbitrary or even entirely wrong. In making up this list I have endeavored to group colors under appropriate headings as much as possible, so that it will be easier to find any desired color, though I must confess that I have not hewed exactly to the line in this regard; I may have placed colors under the wrong grouping, a fact due to the difficulty of determining just what class the color in question may have belonged to. But if any desired color formula is not found where you are led to suppose it to be, search elsewhere on the list until it is found.

It is to be remembered that in all cases excepting where otherwise stated, all pigments mentioned in these formulas are to be of the best grade. Thus, ochre means French yellow ochre, sienna best Italian sienna, and not the American or other inferior sienna.

In most cases proportions are given, but they are mostly approximate only, as it is impossible to give exact proportions, shade and strength of even the best pigments varying. This will not appear so strange when we consider that the earth colors, for instance, are from Nature's storehouse, dug from the earth, though even the chemically prepared pigments vary, for no two color makers may use the same process or formula. Take the best colors made by the color maker, compare them for color, tinting strength and fineness, and you will see a very great difference in many cases, and some difference in all cases. Nay, even the one manufacturer may put out colors that vary, for his purchase of the raw materials may vary. He would like to maintain a standard, but finds it impossible to do so. Hence in taking the formulas given in this list, the painter must be governed by his knowledge of colors and mix according to his skill.

In giving a formula for a color it is usual to name the most important ingredient first, the one next in importance following, and so on through the formula. The first one named will usually be the base. Thus, white, red, yellow. White is the base, and is to be toned or tinted with the red, the mix then being toned with the yellow.

Color Formulas

Apple Green.—White lead 96 lbs., light chrome green 4 lbs.

Buff.—White lead 80 lbs., French ochre 20 lbs.

Colonial Yellow.—White lead 95 lbs., French ochre 3 lbs., lemon chrome yellow 2 lbs.

Citrine.—White lead 75 lbs., French ochre 15 lbs., burnt sienna 4 lbs., drop black 6 lbs.

Cream.—White lead 98 lbs., French ochre 1½ lbs., lemon chrome yellow ½ lb.

Drab.—White lead 88 lbs., French ochre 10 lbs., lampblack 2 lbs.

Fawn.—White lead 94 lbs., French ochre 5 lbs., burnt Turkey umber 1 lb.

Flesh Color.—White lead 95 lbs., vermilion 3 lbs., lemon chrome yellow 2 lbs.

Green Stone.—White lead 94 lbs., medium chrome green 3 lbs., raw Turkey umber 3 lbs.

Ivory.—White lead 98 lbs., raw sienna 1 lb., lemon chrome yellow 1 lb.

Lead Color.—White 98 lbs., lampblack 2 lbs.

Lilac.—White lead 96 lbs., Tuscan red 3 lbs., ultramarine blue 1 lb.

Light Olive.—White lead 70 lbs., French ochre 15 lbs., medium chrome yellow 5 lbs., raw umber 6 lbs., drop black 4 lbs.

Olive Drab.—White lead 75 lbs., raw umber 13 lbs., medium chrome green 7 lbs., drop black 5 lbs.

Peacock Blue.—White lead 90 lbs., light chrome green 5 lbs., ultramarine blue 4 lbs., drop black 1 lb.

Pearl Gray.—White lead 98 lbs., drop black 1½ lbs., Tuscan red ½ lb.

Table of Color Mixing

Pale Tints

Buff.—White, ochre and burnt sienna.

Blue.—White, and ultramarine blue.

Cream.—White tinted with ochre or medium chrome yellow.

Drab.—White tinted with raw or burnt umber.

Fawn.—White tinted with raw sienna and vermilion.

Grey.—White tinted with ultramarine, blue or lake.

Grey.—White tinted with burnt sienna and indigo.

Grey.—White with vegetable black or lake.

Grey.—White tinted with Prussian blue and Indian red.

Lilac.—White tinted with vermilion and ultramarine blue.

Lavendar.—White tinted with Prussian blue and lake.

Pink.—White tinted with crimson lake or rose pink.

Pink.—White tinted with vermilion or Indian red.

Peach.—White tinted with vermilion, ochre and purple brown.

Salmon.—White tinted with vermilion and ochre.

Stone.—White tinted with ochre and raw umber.

Straw.—White tinted with light chrome yellow or Dutch pink.

Deep Tints

Brown.—White, Prussian blue and Venetian red.

Brown.—White, purple brown and lake.

Brown.—Same with some addition of vegetable black.

Brown.—White, indigo, ochre and vermilion.

Chocolate.—White, lake, purple brown and vegetable black.

Green.—White, ochre and indigo.

Green.—White raw sienna and Prussian blue.

Green.—White, chrome yellow and Prussian blue.

Lead Color.—White and black.

Orange.—White, orange yellow and lake.

Orange.—White, Dutch pink and lake.

Violet.—White, vermilion, Prussian blue and lake.

Self-colors

Sage Green.—White, Antwerp blue and ochre.

Pea Green.—White and Brunswick green.

Duck Egg Green.—White, ultramarine blue and light chrome yellow.

Blue.—White and Antwerp blue, or white and indigo blue.

Purple—White, ultramarine blue and lake.

Reddish Drab.—White lead 90 lbs., French ochre 8 lbs., burnt umber 2 lbs.

Sage Green.—White lead 92 lbs., medium chrome green 5 lbs., raw umber 3 lbs.

Salmon.—White lead 88 lbs., French ochre 8 lbs., medium chrome yellow 2 lbs., bright Venetian red 2 lbs.

Silver Gray.—White lead 97 lbs., French ochre 2 lbs., lampblack 1 lb.

Sky Blue.—White lead 99 lbs., Prussian blue 1 lb.

Straw.—White lead 90 lbs., French ochre 7 lbs., medium chrome yellow 3 lbs.

Spruce.—White lead 80 lbs., French ochre 10 lbs., medium chrome yellow 6 lbs., bright Venetian red 4 lbs.

Tan.—White lead 90 lbs., bright Venetian red 7 lbs., medium chrome yellow 2 lbs., lampblack 1 lb.

Terra Cotta.—White lead 85 lbs., burnt sienna 15 lbs.

Paint and Color Formulas

Greens for Common Uses.—Ultramarine blue and yellow ochre. Black and yellow ochre. Black and chrome yellow. These make quite permanent paints and the cheaper pigments may be used in some cases, resulting in a saving in cost.

Browns for Common Uses.—Black and orange chrome yellow. Black, orange, chrome and Venetian red. Yellow ochre and Indian red. Chrome yellow and Indian red.

Rich Bottle Green.—Yellow ochre, black japan, Prussian blue.

Rich, Warm, Sepia Color.—Black, orange, chrome, and a touch of vermilion.

For Ornamental Cast Iron Fence Work.—Ground color of blue, made from white and Prussian blue. Finish with black japan and Prussian blue, with some powdered aluminum in it.

Paint the ground with emerald or medium chrome green, and glaze with ultramarine blue.

Ground in yellow colors and white mixed. Finish with chrome yellow and burnt sienna with some gold bronze powder over it.

Rich Bronze Green.—True bronze greens should be made from orange chrome yellow, drop or ivory black, and a small portion of burnt Italian sienna. It should, when painted, show a bronze luster in the sunlight.

However, times have changed somewhat, and the trend of the times is to have bronze greens decidedly green, very near the tone of bottle green, and to make a good, sharp bronze green of the most favored tone is to use a good commercial brand of chrome green, drop black and burnt Turkey umber or burnt Italian sienna, all ground fine in oil, selecting the proper shade of chrome green to make either a light or dark shade. The umber or sienna can be omitted, but black is an essential part of bronze and bottle greens. Lampblack, however, imparts a certain dullness to these greens, and gasblack makes them too brownish in tone. In mixing these composite greens a very good portion of a good, strong drying japan must be added, as drop or ivory blacks dry very poorly.

Hints for the Color Mixer Concerning Pigments

White.—Zinc white, being a natural pigment may safely be used with any color. Nor has it any chemical effect on linseed oil or other paint liquid. White lead: any pigment containing sulphur, such as Para reds, vermilion, ultramarine blue (there is a specially prepared ultramarine blue that lead will not affect), and Dutch pink, cannot be used with white lead safely. Nor can lithopone. Sublimated lead: it is nearly as neutral as zinc white.

Black.—Lamp black and drop black may safely be mixed with any other pigment.

Red.—Indian red and Venetian red are both extremely durable colors, and may safely be mixed with other pigments or bases. This assuming they have not been tinted with aniline. Vermilion, imitation or genuine, are little used for tinting. They cannot safely be used with white lead or sulphur based pig-

ments. Para reds cannot be used with white lead, but are safe with zinc and lithopone.

Blue.—Prussian and Chinese blue are identical as to composition, but differ in hue, the first being of a purple, and the second one being of a brilliant brownish cast. Both can be safely used with any base or color. Chinese blue and bright yellow make a very brilliant green. Ultramarine blue will turn grey if mixed with any lead pigment. Cobalt blue, genuine or imitation, the latter simply ultramarine blue of a light tone, may be used with zinc, and are mainly used in water colors for interior decoration.

Yellow.—Chrome yellow is made on a lead base, hence is not safe with ultramarine blues, Para reds, lithopone or other sulphur base colors. Zinc yellow is safe with sulphur base colors and bases. It has less strength for tinting than the chrome yellows.

Green.—Few greens are permanent. Chromium green is permanent but high priced, and not much used by painters, being poor of color. The copper greens are more or less permanent, but very poisonous and have little tinting strength. Also they are costly. Zinc green is permanent, can be used safely with any other color, but has little tinting power. Permanent greens may be made by mixing ultramarine and zinc yellow, or with yellow ochre, but such greens are not very brilliant and cannot safely be used with lead colors. Chrome green made by mixing Chinese blue and chrome yellow, or by a chemical process, at the factory, are not permanent, nor should they be used with lithopone.

Vandyke Brown.—This pigment is similar to coal, being of a vegetable origin. It is a permanent pigment, but coarse and transparent, and not suited to tinting or other form of paint. It is simply a good

glaze color and staining pigment, useful in graining, particularly.

Earth Colors, or Natural Oxides.—These will include the siennas, ochres, umbers, metallics or iron oxides, Venetian reds, Indian reds. If not doctored with other substances, such as aniline with Indian red, or chrome yellow with ochre, these pigments are absolutely permanent, holding their integrity until the oil goes.

LINSEED OIL

INSEED OIL is obtained from the seed of the flax plant. In the early stages of the industry the seed was crushed and ground to a pulp, then pressed and the oil extracted at ordinary temperatures. This gave an oil that contained very little foots, was quite light in color, and was of excellent quality for immediate use. The percentage of oil extracted, however, was not very high, so that at the present time no cold-pressed oil is made, but the seed after being ground, is cooked, or "tempered," with steam, which breaks up the plant cells and allows of more complete extraction of the oil. This hot-pressed oil as it comes from the presses is not fit for most commercial uses, as it contains considerable water and gummy substances. It is, therefore, filtered and stored in tanks and finally submitted to various processes, which remove the harmful ingredients and at the same time improve and bring out the special qualities most desired in the various kinds of paint and varnish oils on the market. The quality of the oils, therefore, depends not only on the purity and good condition of the flaxseed, but also on the care and thoroughness with which it is treated in the succeeding operations.

The chief value of linseed oil as a paint is in its power of drying in a comparatively short time to a hard, tough, elastic and durable film when exposed to air. The raw oil is a thin mobile fluid that flows well under the brush and has good spreading qualities. It also has sufficient body to hold up the pigment

and gives a paint that is uniform in color and appearance and does not run or get streaky. The paint film after it has dried should not crack, check or blister, if properly applied on a good surface. It gives off no bad odors, nor does it soften or deteriorate in the sun or when exposed to the weather. No other commercial oil possesses all of these proprties to such a high degree. Claims are made for some of these oils and linseed oil substitutes now on the market that, as regards general painting purposes, they are the equal if not superior to linseed oil but these claims have not been fully proven as yet, and until they have been it does not seem wise to run any risk when the best results are required, and where conditions are at all severe. In many cases the claims for these linseed oil substitutes are not true and their use results in great trouble and expense on the part of the painter, as well as considerable loss of reputation to him.

Raw linseed oil, as it comes from the press, is not yet suitable for use, and, as stated above, has to be filtered and stored before used. It is also further treated in different ways, depending on the use to which it is to be put. Several grades or varieties of linseed oils are, therefore, in the market, designed for different kinds of paint manufactured for the master painter, varnish maker, leather industry, for linoleum, etc., etc. The chief grades are the following:

Raw Oil.—This is the original oil pressed from the flax seed and from which all the other special oils are prepared. Before being sold to the trade, however, it must first be very carefully filtered and stored for a certain length of time. The "foots," as they are called, which are often found in an old barrel

of linseed oil are the gummy or mucilaginous matters which separate out of the oil on storage. The greater part of these are removed in the filter presses and storage tanks before the oil is shipped to consumers, but it is impossible to remove all of it from the raw oil, as it continues to settle out for a great length of time. The quantity of foots in a fresh raw oil depends partly on the condition of the seed, on the care used in cooking and pressing it, and in filtering. It depends also on the kind of seed which is used.

For example, the Calcutta seed gives oil which has less foots than does that from the United States and Canada. This is partly the reason why in the old days Calcutta oil was valued so highly by the paint and varnish trade. At the present time, however, this does not hold so true, as with the improvement in the methods of extraction and preparation of the oil from domestic seed, it is equally as good as any other, and is now given a preference in this and other countries.

A raw oil improves with age by reason of the more complete separation of the foots. It is the foots that tend to make the paint "tacky," soft, as well as slower drying, and the paint also is not so durable.

The chief use of this oil is in the grinding of pigments and in the mixing of paints by both the paint manufacturer and by the practical painter himself.

Boiled Oil.—There are several boiled oils on the market, each with its own particular uses. They are all made, however, by boiling the oil with prepared dryers under careful control and supervision. Each manufacturer has his own method of boiling, the details of which are rather jealously guarded. The

addition of the dryer to the raw oil causes the resulting boiled oil to dry in from 7 to 12 hours instead of from 48 to 72 hours, not on account of the oxidizing action of the dryer on the oil, but by its action as a carrier of oxygen from the air to the oil. It acts as a sort of go-between in first taking up oxygen from the air and then giving it up to the oil, thus causing the latter to dry and harden more quickly than it otherwise would do.

The boiling of the oil also sets free the "mucilage" in the oil, practically all of which is removed in the process. A boiled oil containing a large excess of foots should always be looked upon with suspicion as showing evidence of having been "bung-hole-boiled," *i. e.*, of the drier having been added to the raw oil after it has been placed in the barrel without being boiled at all. A certain amount of foots, however, is usually present, which, in a great many cases, has settled out after the oil was put into the barrels, and cannot be overcome, as this quality of oil cannot be filtered commercially by the manufacturer.

Among the different boiled oils on the market we would mention the following:

Kettle Boiled Oil.—In the old days all boiled linseed oil was prepared in an open kettle heated by direct heat from a fire built beneath it. This has to be very carefully done, not only on account of the danger from fire, but also on account of the possibility of overheating and damaging the quality of the oil. If properly prepared, however, it is of the highest quality and usually commands a somewhat higher price than ordinary boiled oil. It is usually slightly darker in color, chiefly on account of the higher temperature to which it has been raised.

Ordinary Boiled Oil.—This is much the same as kettle-boiled oil, except that it is heated in steam-jacketed tanks or kettles and larger quantities of oil are taken at a batch. The oil is also probably not raised to such a high temperature, although if carefully prepared, should be of good quality for most purposes. On account of the lower temperature used in its preparation it is lighter in color than the kettle boiled. A very large percentage of the boiled oil of commerce is made by this process.

In addition to these principal kinds of linseed oils there are certain other special oils, each of which has its uses. Among these we would mention:

Heavy Raw Oil.—This is a raw oil treated in such a way as to make it less fluid and with more body to it so that it can hold up a heavy pigment in suspension better than ordinary raw oil. The pigment does not settle so quickly and the paint does not have to be stirred up so much while it is being used. The coat of paint is, therefore, more uniform in appearance and more pleasing results are obtained. It should dry in a slightly shorter time than ordinary raw oil, but not as quickly as boiled oil. Its principal use so far is in the grinding of pigments by the paint manufacturer, although we do not see why it should not be equally valuable to the painter himself.

Heavy Boiled Oil.—This has much the same qualities as the heavy raw oil, except that it dries more quickly, and is used by the paint manufacturer and painter where he requires a boiled oil for heavy pigments and where quick drying is essential.

Extra-Pale Boiled Oil.—This is a light-colored boiled oil with specially quick drying properties and is used in the grinding and manufacture of light-colored paints and in enamels.

VARNISH OIL.—As its name signifies, it is used for the manufacture of varnishes of various kinds. It is not a boiled oil, but is treated in such a way that it will not "break" by any application of heat. When ordinary oil is heated up to moderately high temperature a flocculent gummy precipitate, called the "break," separates out. An oil varnish consists of resin dissolved in linseed oil at high temperature, the solution being afterwards thinned with a volatile solvent. Owing to the high temperature used in varnish preparation, the varnish oil must have its breaking property entirely eliminated; but, on account of the expensive and elaborate applications of oil varnishes the oil must retain its durability and elasticity unimpaired by the treatment given to prevent breaking. Each linseed oil manufacturer has his own particular method by which he removes this breaking property, the quality of the product depending partly on the process employed, but largely on the careful attention given to the oil while it is undergoing the treatment.

REFINED OIL.—This is an oil which has been bleached out and made of a yellowish white color. It is especially useful in the grinding of white paints, as it does not injure the color of the pigment. It usually does not "break" on heating, because the breaking element in most cases has been removed. Strictly speaking, however, it is not a varnish oil, although some brands may be used for this purpose if combined with a suitable dryer. Bleached oil like raw, dries slowly, and it is customary to mix suitable dryers with it. The process of bleaching has to be carefully controlled since if it is carried too far it injures the good qualities of the oil. For this reason a very white oil is not to be recommended.

Aged Oil.—This is a thick, heavy oil which has been partially oxidized and the "break" removed. It dries, therefore, somewhat quicker than ordinary raw oil. Its special use, however, is in the manufacture of patent leather and linoleums, in which industries large quantities of it are used.

Adulteration of Linseed Oil and Linseed Oil Substitutes

Within the past few years this has been practiced more than formerly. With the increasing demand for linseed oils and its increased price, many attempts have been made to find an oil which would take its place and at a lower cost. So far this has not been completely successful, aithough for some purposes, as in the case of cheap paints, for steel work and other similar work, some of these oils have found considerable use. For woodwork, however, both interiors and exteriors, and where the highest class of painting is required, a substitute oil has yet to be found which will completely take the place of linseed. Some of them are used in admixture with linseed oil and are sold under various trade names, apparently chosen to mislead the public as to their real character.

In all fairness to the manufacturers of linseed oil, we must say that we do not believe any of them knowingly adulterate their products. Of course, cases of bad oils have come to our attention in which the fault was due to improper preparation of the oil before being shipped. In most cases, however, the trouble is found to be due to adulteration of the oil after it has left the manufacturer, by unscrupulous jobbers, retailers, etc. This is the case particularly when the price of oil has advanced to a point where

it makes it profitable to add 5, 10 or even 20 gallons of some other cheaper oil to the original barrel of linseed. In other cases where only a small quantity of oil is sold it has been found that the measuring can or container has not been clean, and as a result all manner of trouble arose when the oil came to be used.

The oils which are most commonly used for this purpose we have found to be:

Rosin oil, mineral oils, such as benzine, kerosene, and even some grades of lubricating oils; fish oils, China wood oil, Soya bean oil, corn oil, hemp or rape oil.

When these are added by the jobber or retailer they are almost certain to seriously affect the quality of the oil and cause damage to the paint with consequent loss of time money and reputation to the painter. The cheapest and most frequently used adulterants are the petroleum oils. These are lighter in weight than linseed and consequently reduce the specific gravity. Rosin oil is, therefore, frequently added with them to increase the specific gravity. Fish or menhaden oil is sometimes used, the latter forming a constituent of various smokestack paints, but should never be used for interior work on account of the smell given off by the dried paint. It also causes darkening of the color in time. The worst linseed oil substitutes are those consisting of solutions of rosin in hydrocarbon oils, which are again mixed with tar oil and rosin oil. Such imitations dry without durability. Other substitutes are obtained by dissolving metallic resinates in tar oil or petroleum. Many substitutes are made with rosin oil, but they are apt to dry very slowly and remain sticky, and when used for painting will damage even a subsequent good coat, so that nothing but actual

scraping off will remedy a coat of paint which proves defective as a result of using rosin oil.

An oil sometimes used for adulteration is corn oil, which, however, possesses practically no drying properties and can only be used in small quantities with linseed. At the present retail price for linseed of about 65 cents per gallon and for corn oil at 63 cents per gallon, it does not pay the retailer to do this.

China wood oil, or tung oil, is rapidly becoming conspicuous as a linseed oil substitute. As received from the Chinese, it is often heavily adulterated and considerable variation in shipment of this oil is found. The crude oil dries with extreme rapidity, but with an opaque film of wax-like character with no elasticity. It cannot be used in its raw state, and requires to be chemically treated. This has to be very carefully done or else the result is a failure. Many firms have tried to introduce this oil as a substitute for linseed oil, but without any great measure of success. When heated to about 350° F. it suddenly thickens to an insoluble gelatine-like substance which cannot be softened again. It is nearly always used in admixture with linseed oil. Its characteristic lard-like odor can usually be detected, even when only small quantities are present. This is found to be an objection to it for use as a varnish. It does not dissolve in alcohol and hence cannot be used for spirit varnishes or lacquers. In cheap oil varnishes it dries with a flat, frosty, crawling surface. Varnish makers claim that by the use of China wood oil a satisfactory varnish may be prepared, but the process is one of much delicacy, and few manufacturers have been successful with it. The rosin content of the treated wood oil is also apt to cause checking when it is used

to any extent in paints for the protection of wooden surfaces.

Soya bean oil is used by some paint manufacturers who claim that certain pigments are less liable to harden in the package when ground in an oil mixture containing Soya bean oil than with straight linseed oil. It, however, is not really a drying oil, but a semi-drying oil; on this account it is not nearly so good as linseed oil for paint purposes. Tests which have been made with this oil show it to dry much more slowly than linseed oil, and the color of the paint becomes darker upon exposure than is the case with a paint made from straight linseed oil.

Some of these adulterations can be often detected by the painter by the ordinary application of the senses of smell and sight; also by observing the results obtained. In most cases, however, only a chemist can accurately do this, and then only with siderable difficulty.

It can thus be seen that linseed oil as a paint oil cannot be replaced by any of the other drying oils now commercially available for work of the highest character, and this is the only kind of work which any painter wishes to do if he has any regard for his own reputation and for the interests of his customers. We have endeavored to explain to you the properties of linseed oil, which make it so valuable to painters, and to the paint manufacturer, and also the reasons why linseed oil is superior to any other oil for these purposes. The statements which we have made and the facts given above have been proven many times by men of the highest standing and reputation, as well as by the actual experience of nearly every practical painter. The time may come when process will be worked out which will produce

other oils of equal quality, but this has not yet been done, nor have the claims made by manufacturers of other paint oils that they are the equal of linseed oil in every respect been proven by practical experience and trial.

Testing Linseed Oil.—Chemical analysis is the only accurate way to test an oil. As this is not practicable with painters and only can be done at considerable cost, in the laboratory, we must use some of the simpler means. There is the "spot test," a very reliable method. On a sheet of glass place a spoonful of oil, and allow it to flow out; then with a dropper let fall in the middle of the oil a drop of concentrated sulphuric acid; if the oil is pure the acid will not spread, but will burn the oil in a spot of about ¼ inch diameter. If the oil is impure either a bloom will appear on the surface surrounding the spot, or minute veins will radiate from the spot towards the body of the oil.

The cold or freezing test is another good one. Pure linseed oil becomes about the consistency of lard at a temperature of about 16° to 25° F. An oil that becomes as thick as lard at a higher temperature than this is not pure linseed oil. Cottonseed oil congeals at about 5° above zero, F., making 20° to 25° difference between it and linseed oil. Fish oil at about 32° F., while the oil from warm-blooded animals will congeal at a point above this. Rosin oil congeals at zero. Rapeseed oil at about 25° F. above. Hence, when any of these oils are mixed with linseed oil the resultant oil will assume a semi-solid appearance at some point above 16° F., below zero, according to the kind and amount of adulteration of oil used.

A good quality of linseed oil, raw, will gain from 16 to 17½ per cent. in weight in drying, and boiled oil, say from 15 to 17 per cent. An oil containing benzine or turpentine will show a decided loss during the first hours of drying and some of the cheap oils used in paint will show an ultimate loss in weight, instead of gain. With a chemist's balance at hand the quality of the oil may be ascertained by mixing it with an excess of an inert substance say silica or barytes, and then weighing the mass from time to time, as it dries.

Substitutes for boiled linseed oil are, as a rule, mixtures of rosin, linseed oil, more or less, crushers' driers, and some thin oil, mineral most likely. Many of these substitutes contain rosin or rosin oil, benzine and kerosene oil. If the painter will use an adulterated oil it would be money in his pocket to make it himself, then throw it away and use as good and pure linseed oil as money can buy. The use of adulterated oil cannot be defended upon any rational grounds, and the man who uses it injures his patrons and himself. It is dishonest.

A very simple and effective way for testing linseed oil suspected of containing petroleum oil is to fill a bottle about one-third full of the oil, then almost fill with a strong solution of salsoda or potash. Shake well, when the mineral oil will separate from the linseed oil, the latter forming with the lye a soap. The mineral oil will not saponify, but remains unchanged.

To test an oil for rosin, take equal volumes of the oil and grain alcohol and mix them well by shaking in a test tube or long bottle. Let stand for one hour, then pour the alcoholic layer into another clean test tube or bottle. Into this alcoholic solution let fall two to five drops of solution of sugar of lead (lead

acetate). Set aside for six hours. If the oil contained any rosin a permanent white sediment will be found precipitated on the bottom of the bottle. This test will also indicate if a boiled linseed oil is a true kettle-boiled oil, or a so-called "bung-hole" boiled oil —raw oil to which has been added a rosin dryer.

The presence of mineral oil was formerly easily detected by its bluish color or bloom, but the adulterators have now succeeded in eliminating this, and hence other means must be employed in detecting its presence. Placing some suspected oil on the palm of the hands and smelling odor of the same, after briskly rubbing the palms together, causing heat, will disclose the easily recognized smell of fish, rosin or mineral oil. Linseed oil has a sweet and agreeable odor, when fresh, but old oil may be quite different from this.

Oil adulterated with petroleum oil will have a cloudy appearance, and the film after drying will be easily removed by scraping with the finger nail. Pour out some oil on a piece of window glass, made perfectly clean, and note the time required for drying. Raw oil takes several days, but it will finally become dry; boiled oil will dry in from 8 to 10 hours, but much depends upon the temperature or atmosphereic conditions.

Oils may be divided according to their drying properties as follows, giving the principal oils of each class:

Drying—Linseed, walnut, tung, poppy, sunflower.

Semi-drying—Rape, Menhaden, cotton, hemp, sesame, Soya bean, maize (corn).

Non-drying—Olive, palm, castor, almond, cod liver.

Linseed oil has more useful qualities than any other single paint oil. A few other oils have merit, but cannot be used in the raw state in the same manner that linseed oil is used. Raw linseed oil is extremely elastic, expanding and contracting with any kind of surface on which it may be used. It is also very penetrating, excepting in cold weather, when the addition of a little turpentine aids it. When raw linseed oil is spread on a flat surface, either with or without the addition of pigment, it gradually crystalizes into a hard film, there being absolutely no evaporation whatever. The best linseed oil, therefore, is the one that will obsorb the greatest amount of oxygen in the least time; in other words, that will dry in the quickest time. A fair or average good linseed oil when spread out in a thin layer as suggested, on a smooth surface and under favorable conditions, should dry and harden in from five to seven days.

Double-boiled oil is that which has reached about 300° C. When boiled four hours at the maximum heat the oil will lose exactly 5 per cent. of its bulk. This adds also to the cost of the boiled oil, yet it retails at about three cents per gallon above the price of raw oil. Boiled oil is not as elastic as raw oil, but it dries quicker, and makes a gloss finish that raw oil cannot. Boiled oil is in fact a varnish, though it does not dry as hard as a gum varnish, of course. Painters, as a rule, when using boiled oil, use too much, which causes wrinkled surface. As to which is the better, raw or boiled, there has been some discussion among practical painters. Boiled oil certainly has some objectionable features, and raw oil few or none, practically speaking. Boiled oil has a tendency to blister, and it will wrinkle the paint if

the painters is not careful in its use. The trouble is, that the oil dries on top, leaving the inside soft, which when the sun strikes it will turn to blistering. The addition of some turpentine to boiled oil will help it, hardening it some, and red lead with it seems to make a good coating. Also graphite paint seems to do better with it. Double-boiled oil is particularly unsafe on exterior work. A correspondent of the *Carter Times* believes that in a cold climate boiled oil is better than raw oil, but that in a warm climate raw oil is best. He says he has used boiled oil on seacoast painting with success. An old painter, who as a boy helped boil oil in the shop, says such an oil paint lasted from 15 to 16 years to his own knowledge. Another painter tells of a job of painting he did more recently, for which he received $10 extra for using an oil that he himself boiled for the job, and that job was in good condition ten years later; there was no scale, crack, or other sign of deterioration. These facts are of great value to us as painters.

Thinners and Solvents

Spirits of Turpentine.—Turpentine spirits, made from the gum or resin, in the old way, thins paint perfectly, does not make the paint "short," aids drying, prevents wrinkling of the paint, reduces the tendency of paint to become fatty, works well over wet wood, on account of being able to take up a certain amount of water, is not affected by cold, and stands a temperature of 30° F. without danger. It is miscible (or mixes) with all the paint oils and thinners, and may be mixed cold with any of the oil varnishes without causing a separation of the gum. Its chief value in addition to being a thinning agent

of paint, is in its flatting property in paint. But it contains an acid that will injure certain pigments, such as flake white or rose madder, which will change color in 12 hours when mixed with turpentine.

Wood Turpentine.—Sometimes called stump turpentine and wood spirit. The dry distilled product has a strong, pungent odor, and takes on a deep yellow color by age, or if kept in the dark. The steam distilled variety has less odor, is water white, and does not turn yellow so soon. It is a quite satisfactory thinner, and is much used in place of the gum spirits. The sp. gr. and flash point of wood turpentine and gum turpentine are similar. Wood spirits obtained from knots and stumps has a strong and pungent smell, so that many persons will not allow it to be used in their houses. But, by re-distilling, this odor is almost entirely removed, and the liquid retains its water-white color for a long time. The crude spirit soon turns a deep yellow, as already stated. The re-distilled, water-white spirit is now classed as pure commercial turpentine; if free from odor it is very good. The diluting power of wood turpentine is the same as that of the gum spirits.

Turpentine Substitutes.—The heavy petroleum distillate, known to the trade as "heavy naphtha," "white spirit," and "heavy petroleum distillate" or simply "distillate," is the base commonly employed for making turpentine substitute. This liquid is water-white, something between benzine and kerosene oil, but does not leave as much grease on white paper as kerosene does. It is not as volatile as benzine, flows better with paint than benzine, but it slightly retards drying. While it is often used alone

as a substitute for turpentine, it is more common to add other liquids to it, to improve it. Thus, by adding 5 to 20 per cent. of wood turpentine to it and rosin spirit, or a mixture of the two, and a little pine oil, we get a better imitation of the true turpentine odor, and makes it mix better with paint and varnish. Benzol is another liquid sometimes added to these imitations. A substitute containing no turpentine may be made from benzine 80 parts, kerosent 18 parts, and rosin spirit 2 parts. This makes a water-white fluid with a strong turpentine odor, due to the presence of the rosin spirit; it works well in paint, but not so well in varnish.

Another substitute is composed of equal parts of rosin spirit and heavy benzoline, and turpentine twice as much. Or, turpentine 1 part, benzol 1 part, and petroleum spirit 2 parts. Or, 1 gal. turpentine, 1 gal, rosin spirit, 2 gals. petroleum spirit, 2 lbs. rosin, and 2 lbs. gum sandarach. And so on, almost indefinitely. Most turpentine substitutes are made from foreign petroleum oil, which does not give a good burning oil, American petroleum being the best in the world for illuminating purposes, but which, particularly the Pennsylvania oil, won't make a good substitute, being too light. The Russian "turpentines" are too greasy and do not evaporate out well, some not at all perfectly. Some of these substitutes smell very like real turpentine, but have a woody rather than a gum odor, due to the presence of wood turpentine.

How to Clarify Discolored Turpentine.—The turpentine becomes discolored from standing in rusty containers. Here is a method for clearing it: (1) Agitate the turpentine with a small quantity of

nitric acid, using a small quantity of the turpentine for the experiment, and after it settles draw off the clear portion, the nitric acid going to the bottom. (2) Take a saturated solution of oxalic acid, using hot water, the addition of some acetic acid making it stronger. But try either or both ways; that is, with or without the acetic acid in the oxalic acid solution. Agitate the turpentine with the acid and after it settles, draw off the clear solution.

Camphorated Turpentine.—Camphorated turpentine may be obtained by adding an ounce of camphor gum in one gallon of turpentine spirits. It is useful in reducing the brittleness of some hard gums used in varnish making. There is a stronger preparation called "heavy camphor-turpentine," prepared by the addition of 2 lbs. of gum camphor in a gallon of turpentine. The weaker comphor-turpentine is used in some enamels to make them more elastic and easy to spread. It is also useful in shellac varnish for the same purpose.

Benzine.—Benzine is a good thinner and a great solvent of oils, but it lacks some of the best properties of turpentine. It is more volatile; as a thinner of oil paint it abstracts too much oil, leaving the pigment with insufficient binder. It is a better thinner, as mere thinning goes, than turpentine, but it makes paint "short," it does not level or flat well under the brush; a fault particularly noticeable in varnish thinned with it. The tendency of benzine when mixed with paint is to make the paint more soft than common after the paint has dried. Grainers say that when the graining ground has been made of paint thinned with benzine there is a tendency of the paint to rub

up. Benzine seems to leave some paraffine, causing the paint trouble spoken of.

It is well known that benzine will not flat paint as turpentine does; thin it with benzine until like milk for consistency, and when dry the paint will have more or less of a gloss. Again, white paint thinned with benzine will yellow, but with turpentine it will not. It is simply useful for thinning out the paint when that is all you desire of it. It will not injure the paint, as it completely evaporates. Why it should yellow paint is hard to understand, unless it is because of the paraffine it is assumed to leave with the paint, and which must be a very inconsiderable amount. It was discovered by oil-cloth makers that benzine yellowed white paint.

When you want to make enamel paint flow easier, some benzine may be added and the end will be achieved, and the finish will have all its gloss. Thin out with turpentine and the gloss would be wholly or partially gone.

Benzine does not work well on wood containing an excess of moisture, owing to the fact that it will not mix with water; turpentine does. Neither will it withstand a high degree of temperature owing to its rapid evaporation; in consequence it is useless in baking or japanning. Also, if chilled to near the freezing point it precipitates the gums in varnish, so that it is easy to see it is not adapted to either a hot or cold climate.

To test benzine for purity place a few drops on white paper, and if pure it will completely evaporate in 7 minutes, leaving no stain.

It is said that benzine may be made non-explosive by adding a pound of table salt to five gallons of the fluid, which will also partially deodorize and refine

it. After it has set for some time the clear liquid may be drawn off.

Deodorized benzine took the place of turpentine in the North during the war of the States in 1861-6. Turpentine was too costly or impossible to procure then, and benzine also was high.

Rate of Evaporation of Benzine.—Benzine has the highest rate of evaporation of all the paint thinners, even higher than that of the very inflammable coal tar product known as solvent naphtha. Slow evaporation generally means slow drying, while rapid evaporation should mean quick drying, but more often signifies quick setting, quite another thing. The whole subject of evaporation is quite a problem, one that our experts even do not understand perfectly. We do know that it has much to do with the behavior of paints and varnishes. One peculiar feature in regard to evaporation and the drying of paint and varnish is that the rate of evaporation at a high temperature in a closed room is not as great as at a lower temperature with a free circulation of air. Evaporation depends upon the temperature, amount of moisture in the air, and the movement of the air. The rate of evaporation is governed by the time of exposure, area of the surface, and the volume of the liquid.

From the result of many experiments it has been found that the "rate of evaporation" per hour, per square inch, for a given volume of water, alcohol, turpentine, and benzine is as follows:

Water (by weight)	0.61	per cent.
Grain alcohol	5.10	" "
Wood alcohol	9.74	" "
Turpentine	1.10	" "

Wood spirits	1.58	per cent.
Benzine	4.70	" "
Gasoline (87 deg.)	55.11	" "

When benzine is adulterated with coal oil, it gives forth a persistent and disagreeable odor. To test, put a piece of pitch in the suspected benzine which, if the benzine is adulterated, will soon be dissolved, but will color the liquid less on account of the presence of the petroleum oil.

To deodorize benzine it may be allowed to fall, drop by drop, into a vessel containing sulphuric acid, which is fitted with an abducent tube carrying the benzine in the form of a vapor to a receiver, in which it is condensed as a liquid having the odor of honey. The temperature of the mixture of benzine and sulphuric acid should be carried to about 150°.

Benzine may be distinguished from benzol in the following way: Benzine is colored violet by a crystal of potassium iodide, while benzol is colored carmine. If to clear benzine a few drops of a clear ether solution of gum sandarach are added a persistent cloudiness is produced in the benzine, while with benzol, treated in the same way, the cloudiness will soon pass away. Finally, if the benzol is shaken with a drop of alcohol it will become clouded while benzine will remain clear.

Benzole.—Variously referred to as benzol, coal tar naphtha, and solvent naphtha, is a product of bituminous coal, obtained by distillation; a by-product of gas works, from the resultant gas tar. It is a water-white liquid, volatile, and leaving no residue after evaporation. It is a perfect solvent for oils, rubber, gum resins, etc. In connection with acetone it forms the paint and varnish removers of commerce.

It is occasionally used with turpentine as a mixture for cutting damar gum. It is also added to paint mixtures to prevent the granulation of rosin contained therein, and in paint it is also useful in softening up an undercoat, so that the succeeding coat can take hold better. Also a good thinner for paint and varnish. In its brushing qualities it resembles turpentine spirits, more so than any other liquid of its class. It is one of the best solvents known for rosin, and it is unaffected by a cold temperature. It mixes easily with turpentine, benzine and oil. Being a very inflammable liquid it must be used with caution and insurance companies object to it. Its market price, as a rule, ranges higher than that of heavy petroleum spirits, which are sold as turpentine substitutes. In painting it is useful for priming hard pine and cypress, the liquid penetrating deeply and dissolving the hard gum that is in those woods. But it should never be used in any subsequent coats, though it may with advantage be used with a coat of paint applied over a hard old coating of paint. Useful also for coating over varnished surface before coating with paint.

Used in baking enamels and paints, where the benzole is driven off by the heat, there is very little trouble, but in paint and applied cold, as usual, there is a tendency to soften up the undercoats so that they either wrinkle bad or the paint loosens.

EVAPORATION TESTS.—

Pure benzol	10	minims
100 per cent. benzol	13½	"
50 per cent benzol	23	"
160 per cent. benzol or solvent naphtha	107	"
Turpentine	142	"

KEROSENE OIL.—Kerosene or coal oil, a distillate of petroleum, imparts elasticity to paint and varnish, especially baking varnishes, etc., promotes flow, and increases the leveling property; it is very repellant of water. Its greatest fault consists in its not drying, though with rosin and manganese it is possible to produce a fairly good combination drying oil. In the South, the home of pure turpentine and in the Southwest and California it is much used as a paint thinner, and to a smaller extent it is likewise used in the North. In California particularly it is used to the almost total exclusion of turpentine. This is why so little good painting is found on the Pacific coast. It is a very treacherous thinner, as it greatly retards drying and causes separation of oil and pigment on metal. When used in paint the succeeding coat is more than apt to crack or peel off. A very small quantity might be permissible in rough paints, as for rough barns, etc; but for good work it should not be thought of.

All thinners and solvents are influenced by temperature, moisture and absorption; hence these factors must be taken into consideration when different thinners are used.

In a very dry climate, where lumber is dry and the air without moisture at any time, say as in Arizona, a paint thinned with kerosene will work very well, as the coal oil is absorbed by the wood, which it tends to preserve against decay or dry rot. The small amount of kerosene oil remaining with the paint will impart a certain amount of elasticity that will prevent cracking or checking at least. But on metal the case would be different. On wet wood a paint containing kerosene will be apt to run, and it will be very slow in drying. Eventually 85 per cent. of the

kerosene will evaporate. The relative evaporation of kerosene being 13, as compared with turpentine as 1100. While some painters report very good results from using kerosene oil in paint, still we must object to its use, as a paint thinner, for all the evidence against it is as 100 to 1.

"The first occasion I had to use benzol was when I had to stain an old varnish pine surface in mahogany, about a year and a-half ago. I tested it by mixing my stain in the usual way, with oil, benzine and colors, rather thick, then I added about one quart of benzol to the gallon and stained the wood with it, and as the owner wanted a flat surface, I varnished it with flat varnish; of course I added some japan to my stain. About a month ago I examined this work and found it in excellent condition, not a particle of chipping nor scaling. I tried to scrape it with my finger-nail and could hardly make a mark on it. I have since then used it, as you might say, by the barrel. I use it in all my priming and most of my first coatings on old paint, and all my stains, and use it as freely as I would turpentine or benzine. I had occasion to do quite a large job of staining on Oregon fir about a year ago, and I used in the proportion of one-third oil, one-third benzine and one-third benzol, with enough driers and the proper amount of oil colors to get the shade I wanted. The specifications called for wiping the wood with rags to get the proper shade, but we did not have to use rags at all, as the stain penetrated the wood so well that it had the appearance of a water stain, with the advantage that we had no sandpapering to do. We gave the stain one coat of shellac and one coat of varnish, full body, and had an excellent job, as good as most work receiving two coats of varnish. I attributed

this to the fact that a stain mixed with benzol dries better and harder than one mixed in the ordinary manner. I have watched this job since we finished it, and I know it is in good condition to-day. I have been told by some that the use of benzol in stain will deteriorate the varnish put over it, but up to the present time I have not found it so.

I find benzol is used in a great deal of the turpentine substitutes now on the market, also in the flat wall paints now so largely in use. The manufacturer has been using it a long time, but he has been keeping mighty quiet about it, and it is only in the last year or two that the painter has been getting 'on to it.'

Now that turpentine is getting scarcer, my advice is: Use more benzol and less benzine. I have not had one case of trouble from the use of benzol as yet. What the next year may bring forth I do not know, but I am going to continue its use.

Benzols are made in several different grades. There are grades that will evaporate in ten minutes, and other grades that take as long as two hours. The grade I use and have experimented with is called solvent naphtha, or 160-degree benzol, which evaporates in 107 minutes and is almost as slow as turpentine, and from my investigations I think this is the best, as it is also the safest to use, there being less danger of explosion and fire; therefore being safer to have around the paint shop; also, as the evaporation is slower, it gives the paint a longer time to penetrate new wood, and also a longer time in which to soften up old paint.

Benzol is also used in bronzing liquid, and for that purpose it is better to use a grade that evaporates

in less time, as the quicker the bronzing liquid dries the better the luster of your bronze."—*L. B. Titzel.*

WATER.—Water is used both as a thinner and as an emulsifier, the latter to keep mixed paint in suspension. As water will not mix with oil, it is necessary to employ some medium to effect this union, and we find useful for this purpose alkali, glycerine and alcohol. Oil and alkali form soap, oil and glycerine form a glyceride, and oil and alcohol form a mechanical mixture. In adding an alkali to the oil for thinning paint, care must be taken not to add too much, in which case soap would result, while just the correct amount will form simply an emulsion. One formula may be cited here as showing how the emulsion may be formed: Dissolve four ounces of borax (or two ounces of sal soda) in one gallon of hot water. Then add one pound of gum shellac, either the bleached or orange colored, according to the paint desired, whether white or tinted. The alkaline mixture is kept at a temperature just under the boiling point, and the solution must be stirred until the gum is dissolved. This is usually accomplished in about thirty minutes. Strain the solution and add to any kind of mixed paint, the limit being one part of the solution to two of the mixed paint. The more common addition, however, is about one-tenth solution.

A mixed paint thinned to working consistency with turpentine, benzine, or linseed oil, will take one-tenth its volume of the solution, and apparently not be any thinner. The paint will then work very easily under the brush, and cover very well. The solution is designed to hold the paint in solution, preventing the settling of the pigments which it does. But such a solution-treated paint is properly called adulterated.

Any paint containing more than two per cent. of water is considered to be adulterated.

After the water of this solution has evaporated from the paint there remains the shellac combined with the oil forming a film that is very durable. Zinc white lithopone and other non-porous pigments have a tendency to form an enamel surface and should be assisted by the addition of a more porous pigment, like silica, barytes or whiting, as this will prevent the film from becoming hard enough to scale when the water escapes. When water is vaporized by heat, it expands to several hundred times its original volume, and this expansion causes paint to peel off, particularly where the wood is not perfectly dry.

Carbon Tetrachloride is another solvent possessing many peculiar properties; it is a perfect solvent for all of the substances soluble in turpentine, benzine and solvent naphtha, but unlike the above thinners, it is non-inflammable, and it is impossible to set it afire. It is a colorless liquid like chloroform, and has a similar odor, but in much less degree. It is a perfect thinner for paint and varnish, rendering them less inflammable and hastening the drying by evaporation. Carbon tetrachloride and chloroform are the only two solvents that will not take fire, but may be evaporated from an open dish on a hot stove with perfect safety.

The high price of carbon tetrachloride and its faint chloroform odor prohibit its use as a thinner.

Carbon tetrachloride is a good solvent for many resins, particularly such as are dissolved by benzine and mixed nitric and hydrochloric acids, but are nearly or quite insoluble in alcohol. A very good varnish may be made by dissolving gum damar in this solvent,

heated to 120° F. Some resins of the copal class, which dissolve with difficulty in turpentine, and very slowly in boiled oil, dissolve readily in hot carbon tetrachloride. It also is capable of completely dissolving with alcohol many resins that with alcohol alone dissolve only partially, and with 10 to 20 per cent. added to the alcohol these resins dissolve completely. Gum shellac, sandarach and some other resins, for example, dissolve but slightly in commercial denatured alcohol of 90° strength, owing to the presence of water; but they dissolve completely on the addition of the percentage of tetrachloride named.

Rosin Spirit.—Obtained from rosin by distillation. A good solvent and thinner, but its yellow color and strong odor is against its general use in paint, though it is used in the varnish factory. Its principal use seems to be in the making of turpentine substitutes, as previously pointed out.

Gloss Oil.—This can hardly be classed as a paint thinner, though it is a very thin liquid, used to some extent by painters for size, etc. A factory formula for making rosin oil, so-called, is as follows. F rosin 400 lbs., 59 or 62 deg., benzine 50 gals., producing about 90 gals. gloss oil. It has very little body, sets quickly, but with the addition of a heavy petroleum spirit this is retarded.

Pine Oil.—Pine oil is obtained from the distillation of pine and fir seeds, as a rule, but more or less wood and pitch are used in producing the commercial oil. It has a pale, yellow color, and smells strongly of rosin and spirit, or something like dry distilled turpentine. Not used as a paint oil, unless when added

to mixed paint and varnish, to impart a turpentine odor.

Amyl Acetate.—Obtained from fusel oil and acetic acid by distillation. Used mainly as a solvent for celluloid and gun-cotton, in the preparation of bronzing liquids and spirit varnishes. Odor like banana liquid. Too expensive to be used as a thinner by painters.

How to Distinguish Various Solvents.—The various solvents all have certain characteristics which enable us to distinguish one from the other; amyl acetate and fusil oil are always recognized by their odor; carbon tetrachloride and chloroform by their odor and non-inflammability; benzole or solvent naphtha by its coal tar smell and property of mixing with both alcohol and turpentine; kerosene oil by its leaving a greasy stain on white paper; benzine by its odor, its flash point, and acid resistance; turpentine by its odor; its perfect mixture with varnish, and by the following simple test, which distinguishes crude wood spirit from the rectified spirits of turpentine:

In several small wine glasses or beakers, place about half a fluid ounce of each of the following solvents, viz.: Turpentine, wood spirit, benzine and solvent naphtha. Now add an equal amount of strong hydrochloric (muriatic) acid, the acid must be chemically pure and colorless, then stir with a glass rod. After about two minutes the lower strata or layer of acid will be colored a pale amber or topaz-yellow in the case of pure turpentine; a bright red turning to brown in the case of wood spirit, or an orange brown if rectified, no change in the case of benzine, both strata remaining colorless; while in the case of solvent

naphtha both strata remain colorless for about fifteen minutes, after which the lower strata takes on a very faint pink tinge.

ALCOHOL.—Ethyl or grain. Obtained by fermentation and the distillation of rye and other grains. Grape alcohol from grapes. Absolute alcohol is that which is obtained entirely free from water, a condition not obtained by ordinary distillation, and effected only by the use of some dehydrating substance, as quicklime. Commercial absolute alcohol contains about 1 per cent. of water, and it is used only for special purposes. U. S. Pharmacopœia alcohol means a solution of 91 per cent. by weight of ethyl alcohol and 9 per cent. of water. Proof spirit or dilute alcohol means a solution of 45.5 per cent. of alcohol and 54.5 per cent. of water, both by weight.

AMYL ALCOHOL is the principal constituent of fusil oil, etc.

WOOD ALCOHOL, or methyl alcohol. Known also as wood spirits, wood naphtha, pyroxyllic spirit, and carbinol. Distilled from wood. Since the advent of denatured alcohol, and on account of its very poisonous and generally objectionable character, it is not much in use by painters now.

DENATURED ALCOHOL.—This is simply grain alcohol to which has been added a certain percentage of wood alcohol, usually about 10 per cent., which unfits it for beverage purposes and does not unfit it for all the purposes of an industrial character.

ACETONE.—An inflammable liquid with a biting taste, and obtained by the destructive distillation of

certain acetates, citric acid, starch, gum, or sugar. Used in making chloroform and as a solvent for fats, camphor and resins. Much used in the preparation of bronzing fluids and varnish and paint removers. The addition of one gallon of acetone to 25 gallons of wood alcohol will produce a solvent that will cut shellac more readily than wood alcohol alone.

Fusel Oil.—An acrid, oily liquid of a vile odor, accompanying the making of potato spirits, corn spirits, etc. It consists chiefly of amyl alcohol, hence is also known as amyl alcohol.

Water Glass.—Soluble glass. Silicate of soda. Silicate of potash. Consisting of silica which has been liquified by extreme heat and pressure in connection with potash, giving potassium silicate, and with soda, giving sodium silicate. The latter is that commonly used by painters. It is of a syrupy consistence, and is dissolvable in water.

Some Little Used Paint Oils

Cottonseed Oil.—This is about the least adapted of any of the various linseed oil substitutes that can be used in paint. It is strictly a non-drying oil, and paint containing a very little of it will be slow in drying, while a greater amount will result in a very sticky paint.

Corn Oil.—As this is not used by the painter little need be said about it; besides which its cost is now too great to make it a rival of linseed oil. It was once very cheap, and then paint and putty makers tried to work some of it in, but of course, not with success. It is a poor drier.

Soya Bean Oil.—A semi-drying oil much talked about by paint makers. It may be used in connection with linseed oil, but used alone it will not produce as tough a film when dry as does linseed oil; it does not absorb oxygen from the air to anything like the extent that linseed oil does.

Poppyseed Oil.—A drying oil, the cold-drawn oil being almost water white, while the hot-pressed oil has a pale, golden-yellow color. It is an expensive oil, and it is apt to be adulterated with walnut oil, in which case it is not suitable for fine white zinc and white enamel paints. It is valued in house painting because it will not turn yellow like linseed oil when kept in the dark.

Hempseed Oil.—A good drying oil and has a greenish-yellow color. It would very likely be extensively used as a paint oil if not so costly.

Menhaden or Fish Oil.—From a small fish, larger than a herring. Three grades of this oil are produced, crude, brown, and bleached, or "winter white." The lower grade, the brown, is sometimes used in grinding dark paints, but the bleached is best, as the bleaching process eliminates much of the fish odor, besides making a clearer oil. Owing to its ability to withstand an intense heat, it is found very useful for paints intended for surfaces subject to great heat, such as smokestacks, furnace fronts, etc. Our paint experts consider fish oil as the best of the available oils in place of linseed oil, though much improvemet will first have to be made in the oil to fit it for painting purposes in a general way. It dries well, or in about the same time as linseed oil, drying with a

hard, waterproof film. Treated with litharge at a high heat it becomes very dark and yields an offensive odor.

Rosin Oil.—This oil is obtained by distillation from rosin or pine gum. This distillation gives several products, the last two of which are rosin spirit and rosin oil. Rosin oil is cheap, and some of the cheaper linseed oil substitutes contain more or less of it. Barrel and cheap barn paints are often mixed with it. It dries hard in paint, but afterwards softens up, where exposed to the sun, and cracks very badly in the shade. It is the worst thinner that could be used.

China Wood Oil.—Known in China as tung oil, being obtained from the nuts of the tung tree of that country. It has been used by the Chinese for centuries, for waterproofing boats, for lacquering, etc. The color of the oil varies with the manner of its extraction. In China it is usually heated very strongly, which produces a heavy, dark product. It has the peculiar quality of drying more quickly in damp than in dry weather. An excellent feature is its hard drying properties. Used alone it will dry flat, but the addition of as low as 10 per cent. of rosin by weight, hardened with calcium oxide, will produce a high gloss coating, drying to the hardness of a high grade copal varnish. It is useful for making the cheaper grades of varnish for painters and furniture makers, and for dipping. Exposure to the weather results in dulling the varnish. This oil has no place in the paint shop, being useful alone to the varnish maker, but it is well to know something about its character, as there are varnishes on the market in which tung or

China oil forms a prominent part. Such varnishes, when properly made, are very durable, resisting acids, alcohol, hot water, etc.

When not darkened over much by heat the wood oil is clear and somewhat yellow of color, and has a peculiar odor, something between castor oil and lard oil. With scarcely any taste, it is the most rapid of the drying oils, drying in about twenty-four hours. Linseed oil dries from the surface, but wood oil dries uniformly throughout.

Wood oil has a greater body or viscosity than linseed oil, being considerably thicker, consequently does not possess the penetrative power of linseed and will not adhere so well. Owing to its waterproof character and its peculiar affinity for rosin it enables the varnish maker to produce a cheap varnish of durable quality. A varnish containing 50 per cent. of rosin made without the addition of wood oil, will turn white if immersed in water for a short time, whereas, with an addition of wood oil there will be but little change, the total amount of oil in the varnish being the same in both cases. China wood oil is superior to linseed oil in one respect only, and that is the toughening characteristics it gives to linseed oil varnishes containing rosin. It cannot be and is not used in place of linseed oil, but merely in addition to the latter in certain percentages. Even then it cannot be used in its raw state, but must undergo certain treatments first. Recently there has appeared on the market a paint oil composed of linseed oil and a treated wood oil, which has given fairly good satisfaction.

DRIERS

DRIERS for linseed oil may be divided into two classes, oil driers and resin driers. Those belonging to the latter class are generally called japans. Of these two classes there are numerous varieties differing in color, consistency and their ability to dry linseed oil. The function of a drier in an oil paint is to absorb oxygen rapidly and convert the film into a hard insoluble product. The linseed oil during this process is changed into linoxyn. However, the action of the drier does not stop here, but continues its oxidation until the paint film is eventually destroyed.

Oil driers are made in this manner: A certain amount of linseed oil is put into a kettle and heated. Drying salts are added, usually salts of lead and manganese, and the oil run up about 500° F. In running the oil up to this temperature it gathers considerable head and must be whipped down. The temperature is allowed to drop and turpentine, or a mixture of turpentine and benzine, added.

Resin driers are made in much the same manner, except that resin is used in place of linseed oil.

Of these two classes oil driers are to be preferred, because they exert a less harmful action on the paint film.

The drying salts used in the manufacture of driers are quite numerous, but those which find the widest application are salts of lead, manganese and cobalt. Only recently have cobalt salts come into favor, and it is claimed they are less harmful in their action.

They affect the color of the oil only slightly. We must not overlook the properties of the thinning medium as a drier. When turpentine alone is used, it adds to the drying power, but when benzine is used it exerts no such influence.

Temperature and humidity are important factors in influencing the rate of drying. As a general rule, the higher the temperature the more rapid is the drying, and the lower the temperature, the slower the drying. Humidity seems to exert less influence than temperature.

Some pigments influence the rate of drying quite considerably. Thus, lampblack dries very slowly. This effect has been attributed to oil which it contains, but tests made from lampblack containing absolutely no oil give the same results. I am inclined to believe that this phenomena is due to the physical properties of lampblack, and that owing to its extreme fineness a lampblack film cannot breathe with the same facility as an ordinary film. We know that a paint film made from linseed oil and lampblack is very durable, and this durability is no doubt due to the inertness of the lampblack, and that it has no oxidizing influence on the oil. On the other hand, lead compounds, such as white lead and red lead, do have an influence on the oil, so that the chalking of white lead may be due in a measure to the fact that white lead itself exerts a drying action. Certain lakes and aniline colors are affected by driers. In some cases the shade is affected to a considerable degree, due to the influence of the metallic salts in the drier. The bleeding of para reds has been attributed to the destructive influence of driers.

The abuse of driers seems to be the use of more than the requisite amount necessary to dry the paint

film. If the drier used were an oil drier the effect would not be so serious, but would result in the film not having the usual gloss. If, however, the drier were a resin drier, the paint film at first would have a very high gloss, but cracking would probably be the final result.

Strange as it may seem, the use of too much drier prevents drying. Hard, insoluble linoxyn is either not formed, or is dissolved by substances formed by secondary chemical reactions, so that the film remains tacky.

New linseed oil, or oil which is not well settled, affects the drying. A well settled, aged oil will dry more rapidly than one freshly made, for the latter contains mucilaginous matter, which settles out with age.

I believe that the more knowledge a painter has of the material he uses the better are the results he will obtain, and the wider application he will find for the material. Now, applying this to driers, if he had some definite knowledge of the strength of a drier, say it was one to twenty drier, that is, that under ordinary conditions, one part of the drier would dry to the touch twenty parts of linseed oil in twelve hours, he would know just how much to use and he would know just what result to expect.

Coach japan, oil driers and liquid driers are the vehicles most used in house paints and are subject to more abuse than all other liquids together.

Coach japans usually contain a gum (Kauri, Manila, or rosin) and are designed for paint which is meant to dry exceedingly hard. Oil driers are generally made without gum and consist of a lead and manganese treated oil reduced with turpentine or

benzine. The liquid driers are simply a gum or oil drier still further reduced with turpentine or benzine.

The great abuse of driers is in using too much, the result being that the paint is literally burned up by oxidation. If there was some standard for the strength of the different driers or japans, there would be less trouble, but as it is now, every painter is obliged to try out each new brand in order to determine how much to use.

The manufacturer generally advocates the use of 3 per cent. as a maximum, knowing that this amount is practically safe, but 3 per cent. or 1-32 of a gallon of drier to one gallon of mixed paint will produce results depending upon the strength and not the quantity of drier.

A simple method of determining the strength of a drier consists in mixing one fluid ounce of the drier with one quart of raw linseed oil, flowing on glass, standing upright, and noting the time it takes to dry. Comparison should be made with standard samples or previous shipments under similar conditions. The mere drying of the japan itself on glass is no criterion, as "crusher's drier," which dries oil rapidly, does not dry by itself in many hours.

Where a 3 per cent. mixture of concentrated oil drier gives the required result, it is often necessary to add 33 per cent. or more of a cheap liquid drier to produce the same effect.

Under ordinary conditions raw linseed oil will dry in about three or four days, so that if we have made a paint consisting only of raw linseed oil and a pigment and applied it to a surface it would take so long to dry that the dust and dirt of the atmosphere would collect on the freshly painted surface

and spoil its appearance when it finally dried. To overcome this slow drying of raw linseed oil we add driers.

Pale liquid driers are very light of color, and stain very little in white paint, but they are not a strong drier, it requiring more heat to make a strong drier than is used with the white or pale drier, and the heating darkens the drier.

Oil driers should not contain any gums, rosins, etc., being principally linseed oil with siccative properties; it is best for exterior oil painting, as it is less liable to crack, etc., being more elastic. But they are slower than the japan driers, which ought to be preferred whenever quick drying of the paint is desired. Boiled oil may be considered an oil drier, because when mixed with paint it renders the use of any other driers unnecessary. Flat or semi-flat painting requires quick drying, hence the stronger japan driers are indicated.

Paste or patent driers are made in paste form from barytes, white lead, zinc sulphate, acetate of lead, and boiled oil, all in definite proportions.

There are many formulas for making driers for paints, and of course many qualities, as well as kinds for distinct purposes. Care should be observed when using, testing a sample when buying and rejecting all that do not prove satisfactory. Then hold fast to that which does prove good.

A good liquid drier should be of a clear amber color when spread upon glass, and should dry hard and free from tack in eight hours, and after being on the glass 72 hours, it should not resist rubbing with the finger, but remain firm.

Testing Japan Driers.—Attach a sheet of white paper to a pane of glass, and lay glass on table. Pour

three or four drops of raw linseed oil on the glass, and on this place a drop of the japan. Incline the glass a little as the japan touches the oil, and watch carefully the action of the drier. A good drier will unite at once with the oil. If the drier refuses to mix at once with the oil it is a poor article. Now, stir the two together with a pin or similar small article, and note if it curdles or not. A good drier will not curdle the oil it is mixed with.

Another Test for Driers.—Apply the driers to glass and let it dry 36 hours; then take finger nail or knife and scratch it. If it flies off in scales it is poor. If it rolls up, gummy, under the scratching, it is slow but sure, not powerful, also not harmful to paint. If the drier cracks while on the glass it is brittle. The odor of a drier is not a sure test. A liquid drier which, added to the oil in proportions of from 6 to 10 per cent., produces a good drying oil, that is, a hard and glossy surface when applied to a smooth plane, such as glass, in from six to eight hours, at ordinary temperature, is a good article. Color is not really important as far as quality is concerned. A light colored drier is every whit as effective as a dark drier, but the popular preference is for the latter.

Paint Driers

For Dark Paint.—Grind the best litharge to a paste with drying oil. Add a small portion to the paint that is thinned with oil and turpentine, mixing first with a little of the paint.

For White Paint.—Mix together two parts each of zinc sulphate and sugar of lead and mix with two parts of pure white lead or zinc white.

Japan Drier.—To a gallon of raw linseed oil add 12 oz. gum shellac, 8 oz. each of litharge, burnt umber and red lead, and 6 oz. sugar of lead. Boil until ingredients are dissolved, or about four hours. Remove from fire and stir in a gallon of turpentine.

Cheap Japan Drier.—Mix together four gallons of raw oil, four pounds each of litharge, and red lead, and two pounds of raw umber. Boil slowly two hours and add gradually 7½ pounds of gum shellac and boil 30 minutes longer. When well mixed add gradually a pound of powdered zinc sulphate, and when nearly cold mix in thoroughly seven gallons of turpentine.

Litharge Drier.—This being a very powerful drier its use should not exceed 4 parts to 1000 of oil. Red lead should be used even more sparingly.

Lightning drier is made with or without gums, and are benzine mixtures, making a cheaper product. A sample made without gum dried on glass in two hours, and one made with gums dried in thirty minutes. They are not fit for exterior painting, making the paint more or less porous.

The cheapest driers on the market will dry raw oil at the average cost of about ten cents per gallon of oil. A good drier, costing twice as much as the inferior article, will dry the oil at the rate of four cents per gallon, and will do the work well, which the cheap driers will not do. These are facts resulting from tests made by a practical paint man.

Patent or Paste Drier.—This formula is from Scott:

Paris white	120	parts
White lead	50	"
Zinc sulphate	15	"
Sugar of lead	10	"
Litharge	12	"

Grind in 6½ gals. pale boiled oil. This drier is adapted for all lead and zinc paints. For use with such paints as green, blacks, oxides, etc., substitute barytes or terra alba for the white lead.

How Commercial Driers Are Made.—The following formulas are not intended for shop use, but merely show about what the manufacturer of driers uses and how he does it; it is interesting and useful to the painter to know.

Turpentine Japan Driers:—

Raw linseed oil	12½	gals.
Rosin	45	lbs.
Kauri gum	25	"
Red lead	10	"
Black oxide of manganese	8	"
Lime	8	"
Turpentine	25	gals.
Deodorized benzine	37½	"

Strong, Dark Coach Japan:—

Raw linseed oil	10	gals.
Pure lead oxide	20	lbs.
Borate of manganese	¼	lb.
Black manganese oxide	2	lbs.
Kauri gum dust	2½	lbs.
Turpentine	10	gals.
Deodorized benzine	10	gals.

Double Strength Drier:—

Raw linseed oil	60	gals.
Red lead	240	lbs.
Black oxide of manganese	240	"
Petroleum oil	40	"

Turpentine Japan:—

Raw linseed oil	60	gals.
Red lead	120	lbs.

Red oxide of manganese... 120 lbs.
Turpentine ..... 300 gals.

Manganese is an excellent drier, but is apt to turn white paint a pinkish cast. A combination of lead and manganese is best. A high-gloss drier at a low price contains much rosin, and no kauri gum. A good drier contains kauri, chips it is true, but these are just as good for the purpose as whole gum.

The United States navy now does not require turpentine in driers and japans, but a high-grade hydrocarbon thinner. I can see no difference in the action of that drier from a pure turpentine. They don't use any rosin, and they will reject any drier containing it. The Government is more stringent in its specifications for driers than any other buyer in this or any other country. The Government specifications can be obtained by writing to the department and the tests contained in them are very practical.

Action of Driers on Paint

When a film of raw linseed oil is exposed to the air at the ordinary temperature a series of very complex chemical changes follows. I shall not trouble you with details of these changes, but shall simply say that under normal conditions there is a progressive absorption of oxygen from the air, the effect of which is that the oil becomes first viscous, then sticky, and is ultimately converted into a solid, elastic body, which consists largely of a substance called by chemists "linoxin." The oil is then said to be dry. The process of oxidation does not stop with the production of linoxin, but proceeds, slowly or quickly, according to the local conditions, with formation of secondary products, until the film, after reaching a

maximum of elasticity and hardness, begins to crack, powder and perish, and is ultimately destroyed.

It has been known for a long time that if small quantities of certain chemically-active metallic compounds are dissolved in oil, the drying process begins sooner and the rate at which oxygen is absorbed is greatly increased. Those active chemical compounds which possess this property are termed "driers," and their function appears to be that of assimilating oxygen from the air and passing it on to the oil without their own chemical composition being materially affected. They have been termed "oxygen carriers."

Typical modern "driers" or "siccatives," are red lead, litharge, sugar of lead, linoleate of lead, resinate of lead, tungate of lead, borate of manganese, resinate of manganese, acetate of manganese, oxalate of manganese, tungate of manganese, and resinate of cobalt, while mention must also be made of Chinese wood oil and spirits of turpentine.

The effect known as chalking or powdering is particularly liable to occur in the case of paints which contain a preponderance of pigments which are in themselves driers. Familiar examples are white lead and red lead. The oxidation of the oil in such paints frequently proceeds so rapidly and so far that the paint film is burnt up and destroyed. This is particularly noticeable when too little oil has been used in the composition of the paint, and the effect is aggravated when a superabundance of turpentine has been used, there being no doubt that in such case the turpentine acts, in conjunction with the drying pigment, as a very powerful drier. A variety of powdering which is preceded with loss of gloss is found also in the case of paints whose chief constitu-

ent is oxide of iron. The cause of this is different from that which induces chalking in the case of lead paints, and is usually traceable to physical peculiarities possessed by oxide of iron pigments.

Cracking or checking is a defect which is frequently due to lack of elasticity in the paint film, and this lack of elasticity is not infrequently aggravated by the use of an excess of drying material, or by the use of drying material of an unsuitable kind. Some paints which contain considerable proportions of oxide of zinc are liable to this defect, which can only be overcome by the use of prepared thinning and drying materials specially suited to the nature of the pigment.

It appears to be the nature of a paradox to say that paint which contains too much drying material frequently fails to dry. Such, nevertheless, is the case. If oxygen is absorbed too rapidly by a paint film, secondary chemical action takes place which prevents the normal formation of linoxin, and these actions result in the formation of a sticky, non-drying product. A precisely analogous phenomenon is observed when linseed oil is exposed to the air in bulk, the familiar substance known as oil gold-size being produced in this manner.

When paint does not show any tendency to become hard, even when a considerable proportion of drying material is present, but remains wet for an indefinite period, unsuitability of the drier is indicated. Certain driers are slow starters of oxidation, but are efficient accelerators of oxidation when the process has been started. Linseed oil that is too new, or that contains suspended footy or albuminous matter, is very liable to retard, or even to inhibit, the normal action of driers.

Temperature exerts a powerful influence on the rate of drying, as also does humidity in the atmosphere. At very low temperatures drying is greatly retarded, and may even be stopped altogether; and it is often found that paint which has been exposed to a slow temperature, and in which the drying has been checked, does not dry normally afterwards, even when the temperature and other local conditions have become suitable. Moist or vitiated air retards the drying of paint, for the very evident reason that there is not a sufficiency of oxygen in direct contact with the paint film to enable the oxidation to proceed in a normal manner.

The influence exerted by different pigments on the rate of absorption of oxygen by linseed oil is very marked, and is an exceedingly complex, and in some ways abstruse subject. The precise reason why such pigments as lampblack and yellow ochre, which have practically no chemical effect on linseed oil, should retard the drying of that medium is by no means clear, and some of the explanations offered to account for the phenomenon appear to be satisfactory only to the ingenious gentlemen who propound them. When pigments of this kind are in question, it is necessary to use a drying material which contains driers capable of starting oxidation quickly, and also capable of promoting the absorption of oxygen for a considerable period.

SOME FACTS AND FIGURES

OMPARATIVE COSTS OF PAINTS.—In the early part of 1900 a paint making concern made some very elaborate experiments to ascertain the comparative cost of painting with straight lead and with compound leads. The full report may be found in *The Master Painter* for June, 1900. The following is a handy synopsis of the experiments. The experiments were made on a surface basis of 3000 square feet, which is about the average surface, exterior, of a house, new white pine wood, two coats, each coat with separate estimate. The experiment was also carried further to three-coat work, where the "saving in favor of zinc was even more striking."

Formula 1.—French process zinc.....	100	lbs.
Linseed oil	75-44	"
Formula 2.—Dry white lead, Dutch process	100	"
Linseed oil	44-93	"
Formula 3.—French process zinc.....	50	"
Dry white lead, Dutch process	50	"
Linseed oil	61-30	"
Formula 4.—Dry white lead, Dutch process	50	"
Barytes, No. 1 Virginia..	50	"
Linseed oil	38-78	"
Formula 5.—French process zinc.....	50	"
Barytes, No. 1 Virginia..	50	"
Linseed oil	61-30	"

Formula 6.—Dry white lead, Dutch process ..... 33-33 lbs.
American process zinc... 33-33 "
Barytes, No. 1, Virginia.. 33-33 "
Linseed oil ..... 55-03 "

The experiments were made with quantities represented by grams, which corresponded to the larger amounts here given. The proportions are what paint grinders use in making liquid paints. The experiments were not made with a view to show the covering capacity of the paints, or to show how well they would obscure the grain of the wood, but it is interesting to note that in no case did two coats prove entirely satisfactory, though any of them, excepting Nos. 4 and 6 would have passed for ordinary two-coat work. Nos. 3 and 5 were the most satisfactory in general results, with No. 5 perceptibly whiter in color than No. 3.

Formula 1.—To cover 3000 square feet, first coat, would take 53.364 lbs. of paint, containing 30.42 lbs. zinc and 22.944 lbs. oil. Second coat, 33.36 lbs. paint, containing 19.014 lbs. zinc and 14.34 lbs. oil.

Formula 2.—First coat, 71.02 lbs. paint, containing 62.82 lbs. white lead and 28.2 lbs. oil. Second coat, 55.8 lbs. paint, containing 38.502 lbs. lead and 17.298 lbs. oil.

Formula 3.—First coat, 54.576 lbs. paint, containing 16.92 lbs. lead, 16.92 lbs. zinc, and 2.736 lbs. oil. Second coat, 46.218 lbs. paint, containing 14.34 lbs. zinc, 14.34 lbs. lead, and 17.538 lbs. oil.

Formula 4.—First coat, 67.356 lbs. paint, containing 24.246 lbs. lead, 24.246 lbs. barytes, and 18.864 lbs. oil. Second coat, 53.05 lbs. paint, containing 19.08 lbs. barytes, and 14.88 lbs. oil.

Formula 5.—First coat, 45.918 lbs. paint, containing 14.22 lbs. zinc, 14.22 lbs. barytes, and 17.478 lbs. oil.

Formula 6.—First coat, 66.26 lbs. paint, containing 14.14 lbs. lead, 14.14 lbs. zinc, 14.14 lbs. barytes, and 23.841 lbs. oil. Second coat, 50.8 lbs. paint, containing 10.838 lbs. lead, 10.838 lbs. zinc, 10.838 lbs. barytes, and 18.286 lbs. oil.

The report concludes with an estimate of the cost of the paint required for covering 3000 square feet, three coats, using a separate formula. White lead is estimated at 5c., French process zinc a little more, and barytes at 4c., and raw linseed oil at 40c. per gallon. The cost of painting the three coats, formulas as given in preceding table, but with an extra coat, requiring an extra formula that is not given, is as follows:

Formula	1	$4.23
"	2	7.87½
"	3	4.96
"	4	4.23
"	5	3.13
"	6	4.50½

To find the number of gallons of paint that can be made from a mix of 100 lbs. of white lead you may consider that the lead alone is equal to 2¾ gallons. Add to this 2¾ gallons the number of gallons of oil, turpentine, drier, etc., and you will have the number of gallons of paint produced.

It is often convenient and effective when soliciting business to be able to say what pure lead paint will cost per gallon as against anything else the property owner would think of using. For this reason is it well for each painter to make a memorandum to keep

handy showing the cost of all the materials used to mix up 100 lbs. of white lead—cost of oil, turps, drier and colors. By dividing the total cost of lead, oil, colors, turps and drier by the number of gallons of paint thus produced you will get the cost per gallon.

USE OF ZINC PAINT IN BELGIUM.—Specifications for painting used by the engineering department of a large local government institution in Belgium are as follows: Colors are to have a zinc base. White work to be painted as follows:

	1st Coat	2d Coat	3d Coat
Pure zinc white (20 per cent. oil)	640	630	670
Linseed oil	220	160	150
Turpentine	110	180	150
Liquid driers	30	30	30
	1000	1000	1000

The figures refer to parts by weight.

On old oil work only two coats are to be applied, viz., the last two of the above.

Oil coats for ground color in graining oak:

Pure zinc white (20 per cent. oil)	610
Linseed oil	130
Turpentine	170
Yellow ochre	60
Liquid driers	30
	1000

EXTERIOR OIL PAINTING:—

Pure zinc white (20 per cent. oil)	640
Linseed oil	339
Liquid driers	30
	1000

If pale boiled oil is used then too much turpentine should not be used, if the paint is to dry with a gloss. About one part turpentine to three parts oil will be right for interior work, and less turpentine for exterior work. The proportion of liquid driers should not exceed one part to twelve parts oil. The dark liquid driers are, as a rule, better than the light, and the fairly dark zinc liquid driers will stain white zinc paint a trifle, but this will all bleach out after exposure to sunlight.

Covering Capacity of Paint.—The covering capacity of paint, etc., can hardly be given as a set rule, as conditions of surface and character of the paint, etc., are variable quantities, yet we have what may be taken as standards in the matter, they being the results of careful tests made with average conditions. In practice it has been found, for instance, that a good lead and oil paint, one that will not run on a vertical surface, applied to a hard, or non-absorbent surface, will not cover over 650 square feet of a surface. A gallon of paint made from lampblack of the best grade will carry more oil than any other pigment, and this will not cover more than 1000 square feet of surface. A fair estimate of the covering power of shellac varnish shows that one gallon will cover, on white pine, first coat, 400 square feet; second coat, 500 square feet; and the same on succeeding coats or on any like hard surface. Interior varnish will cover from 350 to 400 square feet to the gallon, first coat on bare wood; and nearly 600 square feet on succeeding coats. On hard wood, filled with paste filler, interior varnish will cover from 50 to 75 square feet more of surface than on the bare or unfilled wood.

In painting ordinary outside window blinds of average house size, the usual estimate is one gallon of paint to 16 to 20 pairs of blinds, this giving an allowance for any variation in size or condition. According to my own observation and experience an average pair of blinds will require about a pound of green to four pairs, estimating the green in the can, before mixing. Green spreads well, covering with a very thin coat.

Covering Capacity of Mixed Paint.—The covering capacity of a mixed paint is dependent upon its viscosity, the thinner the paint the more surface it will cover and the film of paint will also be thinner, hence it is the vehicle or liquid in the paint which gives the covering capacity.

It is therefore ridiculous as well as false to claim that a paint made with linseed oil as a vehicle can cover as much or more than a gallon of linseed oil will cover without any pigment in it, as it is a well-known rule that for every pound of pigment added to the vehicle you must subtract covering capacity. Approximately one gallon (7.50 lbs.) of raw linseed oil will cover or spread over 350 square feet of dry, soft wood (absorbent surface), over 650 feet of hard wood (semi-obsorbent), and about 1200 square feet of steel (non-absorbent surface).

Careless spreading of paint will cause a lack of uniformity of thickness of a coating; nevertheless, in any case the attainment of an average estimate of thickness cannot be depended upon. When, however, a paint is advertised to cover 1000 square feet to the gallon, it means necessarily that the coating must average less than 1-576 inch thick, which may be compared with thin tissue paper.

A basis whereby deductions may be made to approximate the average thickness of a coat of paint on a smooth, flat surface, which does not absorb any of the paint, may be readily calculated in the following manner:

A legal standard United States gallon contains 231 cubic inches, and if one gallon of paint is spread over a surface containing 231 square feet, the wet paint will average 1-144-inch thick.

In like manner, should the paint be spread twice as far and cover 462 square feet to the gallon, it would be 1-288 inch, which thickness can be compared to the thickness of the leaves of a book having 288 pages to the inch.

These figures only apply when the paint is applied to a surface properly prepared and at a temperature of not below 65 degrees; at a lower temperature they will cover from 10 to 25 per cent. less surface.

There is a limit, however, to the proper covering capacity of a paint. When you go beyond 800 square feet per gallon covering capacity, you are doing it at the expense of durability, as it has been clearly proven that the most durable paints are those which contain a large percentage of pigment to the square inch of surface, and it is only because carbon black is the finest and bulkiest pigment we can see, that we get such a large covering capacity without injury to durability.

The vehicle is the weak link of the paint chain, and the pigment which best protects the vehicle, or liquid portion of the paint longest from decay, makes the best paint; when you reduce the amount of pigment, as a rule it increases your covering capacity, but when you reduce it so greatly as to not properly pro-

tect your vehicle from decay, then you sacrifice durability for covering capacity.

A railway company advertised for paint for structural iron, to be made from pure white lead tinted with best ochre, to a light greenish-drab. It was to weigh sixteen pounds to the gallon, and to cover up solidly in one coat not less than 675 square feet of structural iron. The best of the paints submitted brushed out to the utmost, covered only 566 square feet, the lowest one on the list covering only 512 square feet, and the films of paint in all cases were such that a second coat of paint was necessary.

Mulder, the able Dutch chemist, estimates that three coats of lead are equal to five coats of zinc; the difference in the covering of these substances, therefore, is merely a question of labor; with fewer coats one can get a better covering with white lead than with zinc, but the same weight of metal will be used.

There is, however, another sense in which covering power is used, which is entirely different from the above; that is to say, zinc oxide is said to cover 33 per cent. more surface than white lead, and a good iron paint will cover more surface than either, but while zinc white covers one-third greater space than white lead, it covers the space with a thinner layer, and likewise with iron paint the thickness of the layer must be taken into account; for example, if a paint has a spreading capacity of 1000 square feet to the gallon, reduced to the thickness of film we have by calculation the following: 1 gallon equals 231 cubic inches; 1000 square feet equals 144,000 square inches; therefore by division 144,00)0231,000(.0014. In other words the thickness of the film is fourteen ten-thousandths of an inch. It appears, therefore, that to have a covering that will protect, the spreading

quality of a paint, if too great, is disadvantageous; the happy medium produces better results.

One gallon of paint made from finely-ground Venetian red in oil, will cover one-quarter more surface than a gallon of paint made from the dry pigment. The former may be applied quicker, it will be easier on the brush, and hold color better. Hence it is economy to use the red ground in oil.—*V. B. G.*

The Oil Determines Spreading of Paint.—Linseed oil is the "spread" in paint, and the number of square feet of surface spread over depends on how thick the paint is. If of equal consistency, all paints made of pure linseed oil will spread over practically an equal number of square feet of surface.

Therefore, if one brand of lead will absorb $5\frac{1}{2}$ gallons of linseed oil, and another will absorb but $4\frac{1}{2}$ gallons of linseed oil, it is a fact that each of the $5\frac{1}{2}$ gallons in the first instance, will actually spread over more square feet of surface than each of the $4\frac{1}{2}$ gallons of paint in the second instance.

This means that all old Dutch process white leads are not physically the same, either in the fineness of particles or in treatment after corrosion—hence, one lead will afford good body with $4\frac{1}{2}$ gallons of thinners, while another lead will afford equal body with $5\frac{1}{2}$ gallons of thinners.

Therefore, the paint in the first instance is materially thicker than in the second instance—and while both have equal body a gallon of the more liquid mixture will spread over more square feet of surface than the gallon of the thicker mixture, without sacrificing body or hiding power. It is also well to note that the paint of the second instance is by far more economical in cost—as well as in spreading power and durability.

100 lbs. red lead and 6 gals. oil will cover 500 sq. yards.

100 lbs. white lead and 6 gals. oil will cover 550 sq. yds.

100 lbs. zinc white and 10 gals. oil will cover 800 square yards.

100 lbs. ochre and 27 gals. of oil will cover 800 square yards.

100 lbs. lampblack and 200 gals. of oil will cover 800 square yards.

For 100 square yards these paints would cost approximately as follows:

200 lbs. red lead at 7c., and 12 gals. oil at 70c. per gal., would cost $22.40.

181 lbs. white lead at 7c., and 11 gals. oil at 70c., would cost $20.37.

125 lbs. zinc white at 9c., and 12½ gals. oil at 70c., would cost $20.

125 lbs. ochre at 3c., and 33½ gals. oil at 70c., would cost $27.08.

143 lbs. Venetian red at 2c., and 37 gals. oil at 70c., would cost $28.76.

125 lbs. lampblack at 12c., and 25 gals. oil at 70c., would cost $32.50.

125 lbs. oxide of iron at 2c., and 31 gals. oil at 70c., would cost $24.20.

Such 1000 square yards of paint, exposed to the elements, lasting so many years, would average an annual expense as follows:

Red lead, lasting 20 to 40 years, $1.07 to 56c.

White lead, lasting 10 to 15 years, $2.04 to $1.36.

Zinc white, lasting 4 to 5 years, $5.00 to $4.00.

Ochre, lasting 3 to 4 years, $7.78 to $5.83.

Venetian red, lasting 3 to 4 years, $9.59 to $7.19.

Lampblack, lasting 3 to 4 years, $63.33 to $47.50.

Iron oxide, lasting 4 to 5 years, $6.05 to $4.84.

The durability of the above named paints is based on raw linseed oil. Boiled or prepared oil paints, exposed to the elements, crack or wash off in about three years, no matter what pigment is used.

The Spreading Capacity of Paints

Square feet covered by ten pounds of paint of average consistency.

On Wood

	1st Coat	2d Coat
Red lead	112	252
White lead	221	324
Zinc white (oxide)	378	453
Red oxide of iron	453	540
Raw linseed oil	756	872
Boiled linseed oil	412	540

On Metal

Red lead	477
White lead	678
Zinc white (oxide)	1134
Red oxide of iron	870
Raw linseed oil	1417
Boiled linseed oil	1296

Approximate Hiding Strength

Zinc white, spelter made	100
Lithopone	100
Basic sulphate white lead	50
Carbonate white lead	50
Neutral sulphate of lead	25
Barytes	2
Oil	0

Covering Capacity per Gallon

The covering capacity of different forms of paint stains, varnishes, etc., is an uncertain quantity, yet we may offer an approximate table of great value to the workman when estimating on work:

Paint over priming or an old but solid surface in good condition, a gallon to about	600	sq. ft.
Red lead paint, on structural steel work, from	500 to 700	"
Enamel paint, interior	630 to 720	"
Floor paint, average surface	400	"
Roof paint, ordinary metal surface	500	"
Ochre priming, average surface	400	"
Oil stain, on an average about	800	"
Liquid stain filler, about	500	"
Hard oil, over liquid filler	600	"
Hard oil, over paste filler	500	"
Varnish stain, about	400	"
Flat brick color, reds, 5 lbs	350	"
Flat brick color, buffs., 5 lbs	300	"
Black asphaltum varnish	350	"
Mixed paint on stone work	250 to 270	"
Mixed paint on iron work	600	"
Mixed paint on plaster	350 to 450	"
Heavy bodied varnish	765 to 810	"
Interior paint, over oil paint	750 to 800	"
Interior paint, over flat	675 to 720	"
Interior varnish, easy flow	800 to 900	"
Bronze paint, from	700 to 800	"
Paint in oil, first coat, on wood	500	"
Paint in oil, first coat, plaster	500	"
Second coat in oil, wood	550 to 575	"
Second coat in oil, plaster	550 to 575	"
Third coat in oil, wood	675 to 765	"

100 lbs. of white lead mixed with 6 gallons of raw linseed oil will cover	550 sq. ft.
100 lbs. of red lead mixed with 6 gallons of raw linseed oil will cover	500 "
100 lbs. of zinc white and 10 gallons of raw linseed oil will cover	800 "
100 lbs. of yellow ochre and 27 gallons of raw linseed oil will cover	800 "
100 lbs. of lampblack and 20 gallons of raw linseed oil will cover	800 "
1 pound of mixed paint will cover, wood, first coat	4 "

THICKNESS OF A COAT OF PAINT.—From experiments with an ocular micrometer in connection with the microscope, we find that single coats of the same paint may vary in thickness from 1-5000 inch to 1-1000 inch. The variations in thickness from these extremes and intermediate points are due to the varying pressure of the brush under the hand of the painter.

Covering Capacity of One Pound of White Lead

Conditions of surface and quality of the lead may vary, so that the following table must be taken only as a close approximation. Even different grades of pure white lead may vary in their covering power. Colors, too, vary in this way. Some paints are short and do not cover at all well. Some spread well but do not cover well. Some surfaces are more or less absorptive. Again, painters differ in modes of application and mixing of paints, especially the priming

However, the table here given will show very nearly how far one pound of white lead, properly mixed, will go, and how long it will take to apply it.

	Lead	Oil	Covered	Time
Prime coat	1 lb.	6 oz.	40 sq. ft.	20 min.
Second coat	"	4 "	51 "	15 "
Third coat	"	4 "	66 "	15 "

Taking the above table as a basis, let us estimate on the outside of a house, frame, that is 32x32x20, taking only the weatherboarding, as estimating in its details has been fully treated in my *Expert Painters' Estimator*. There is in this area of weatherboarding, 2640 square feet. To cover this would require:

Prime coat	66 lbs.	3 gals.	22 hrs.
Second coat	51 "	$1\frac{5}{8}$ "	$16\frac{1}{2}$ "
Third coat	40 "	$1\frac{1}{4}$ "	$16\frac{1}{2}$ "
Totals	157 "	$5\frac{7}{8}$ "	55 "

Relative Absorbability of Heat

Lampblack	100
White lead	53
Shellac	43
Isinglass	52
Varnishes, about	50
Polished Metal	14
India ink	96

One coat of priming will take on 10 square feet of wood surface, 20 pounds of lead, mixed with $1\frac{1}{2}$ gallons of oil.

Two coats, 45 pounds of lead, mixed with $4\frac{1}{2}$ gallons of oil.

Covering capacity on cedar shingles, brushed on: One gallon to 150 square feet surface.

One gallon, two coats, 100 square feet surface. Dipping, three gallons to 1000 shingles. One coat brushed on after dipping, one-half to three-quarter gallons per 1000 shingles.

Spreading Power of Paint

The extent of a surface a given quantity of paint will cover is dependent upon a number of factors; first, there is the pigment and oil to be considered. Volume for volume, a paint made from white lead is heavier than a similar paint made from lithopone or zinc oxide, and volume is the chief governing factor in the spreading power. Another factor is the character of the surface on which the paint is spread. A pound of paint will go further on a metal surface than on a wood surface, because the latter is porous and the paint sinks into the surface of the wood, while in the case of metal it is non-porous and the paint remains on the surface. Different woods vary in their porosity, and paint will go further on oak than it will on deal or beech. Plaster and cement surfaces are more absorbent of paint than either metal or wood.

Covering power is an important item to be considered. This is used to designate two different properties of a paint, hence must be differently expressed. First, covering power means the amount of surface which a gallon of paint will cover with a given number of coats. Second, covering power means the density of a paint, as, for instance, it will take four coats of white lead to cover up a surface that two coats of iron oxide paint will hide or cover equally as well.

In order to distinguish between these two, we will call the first, covering capacity, and the second, covering density.

Amount of Thinners to Use

Priming, for two-coat work: Thin 100 lbs. white lead with $4\frac{1}{2}$ gals. raw oil, $\frac{1}{2}$ gal. turpentine, and driers to suit weather, say from a pint to a quart, best grade.

Second, or finishing coat, 5 gals. raw oil and 1 quart best driers.

The above is for summer weather. For winter thin with $4\frac{3}{4}$ gals. raw oil, 1 quart turpentine, and 1 pint best driers.

For three-coat work, per 100 lbs. lead: Priming coat, $4\frac{1}{2}$ gals. raw oil, 1 gal. turpentine, and from a pint to a quart of best liquid driers.

Second coat, $4\frac{3}{4}$ gals. raw oil, 1 quart turpentine, and 1 quart best driers.

Third coat, 4 gals. raw oil and 1 pint best liquid driers.

It might be better not to indicate quantity of driers, as this is so governed by weather conditions, quality of drier, etc., as to make any certain directions quite impossible. But it may be said that very little of the best driers need be used in any case, certainly more is generally used than should be. Many paint troubles come from the excessive use of driers.

The United States Government standard for white lead is 92 per cent. pure white lead and 8 per cent. oil. It is usually ground in about 8 per cent. oil, a standard formula being $92\frac{1}{4}$ lbs. dry white lead to $7\frac{3}{4}$ lbs. raw linseed oil. A gallon of this paste will weigh $8\frac{3}{4}$ lbs. In general white lead paste runs from 600 to 700 cubic inches to the 100 lbs., averaging about 650 cubic

inches, which corresponds to 2.8 gallons per 100 lbs. This information is given so that you can calculate the amount of paint which 100 lbs. of white lead and oil will give.

Add to 100 lbs. of paste lead 4 gals. raw oil, and 1½ gals. turpentine and you will get 7.2 gallons of paint.

1 cubic foot of white lead in oil weighs.....252 lbs.
1 cubic foot of dry white lead weighs..... 400 lbs.

To paint a square of 100 feet of brickwork or weatherboard surface, using a paint of average consistency, two good coats will take from 10 to 15 lbs., both coats of the same consistency or thickness. With ochre and oil paint it would take about 6 lbs. ochre and 4 lbs. of oil.

To ascertain the cost of a red lead mixture, the liquid yield of 3 lbs. dry lead can be safely figured at 7-16 of a gallon increase over the amount of liquid used. One gallon of this mixture will cover approximately 800 square feet of plain painting on galvanized iron, one coat.

The rule has been laid down that all pigments that require a large percentage of oil in the mixing are superior to those which do not demand so large a quantity. Also that the oxides are more durable as pigments than the carbonates; thus, zinc and iron oxide would be more durable paint materials than white lead, whiting, etc. The admixture of oxide and carbonate seems to give better satisfaction than either alone.

White Lead

100 lbs. in oil.....	2¾ gallons
100 lbs. thinned for priming.....	9 "
100 lbs. thinned for finishing coat.....	7½ "

1 gal. white lead priming will cover.... 1000 sq. ft.
1 " " " finishing coat will cover 600 "
1 " " " 2 coats, will cover..... 300 "

100 lbs. dry white lead in oil will take 6 gals. linseed oil.

100 lbs. white lead in oil contains 1 gal. linseed oil.

100 lbs. white lead in oil will take 5 gals. linseed oil.

100 bls. white lead in oil, thinned, needs 2 pints drier.

TEST FOR PAINT.—The durability of a paint may be estimated from the proportion of driers required to harden the paint, the less driers needed the greater the durability, paints requiring no driers being the most durable of all. To test this rule take two perfectly clean pieces of sheet steel or iron, and paint on one of its sides half-inch stripes with red lead, litharge (no driers in either), white lead, Turkey umber, iron ore (mineral red or brown), zinc white, graphite, barytes. All but the first two pigments require some driers to harden them when mixed with raw linseed oil. Now, on the other side paint with the same pigments in boiled oil. Observe that there are to be two sheets painted alike in the manner indicated. After the paints have dried and hardened, place one of the strips for two or three months in a bath of fresh water, or a severer test in salt water. When taken from the bath you will doubtless find an interesting exhibit. All the paints mixed with boiled oil will be blistered, and the iron ore and graphite paint can be washed off easily. The side painted with the raw oil paints will show the red lead and litharge holding fast, free from blisters and protecting the metal; the white lead will show some small blisters; the umber more blisters; zinc white about the same;

and the iron ore paint full of blisters, large and small, besides dyeing the water and being easily wasted off, and the graphite and barytes will show a like result.

Another test for paint is for the resisting power of same when exposed to the action of alkalies, which have a stronger affinity for linseed oil than has any known pigment. Take the second sheet or plate, described above, and place it in a bath of slightly caustic potash or soda solution, when it will be found that the several paints will dissolve from the surface at the following rates of speed, observations being taken at five-minute intervals:

Pigment.	Minutes.
Barytes	20
Graphite	25
Zinc white	35
Turkey umber	55
White lead	80
Litharge	115
Red lead (not completely)	145

These tests would indicate that red lead and unheated linseed oil make the most efficient protective paint for iron and steel.—*Prof. Matern.*

Estimating at so Much per Ton.—A prominent firm of contractors gives us the following method: For heavy railroad bridge work they estimate that .40 of a gallon will do two coats, arriving at the estimate in this way: The first coat requires .24 of a gallon, and the second coat .16 of a gallon, making in all .40 of a gallon to a ton. For light highway bridges they figure that it takes .70 of a gallon for two coats, that is, .40 for the first coat, and .30 for the second coat, amounting to .70 for the two coats.

They figure to paint a heavy railroad bridge three coats requires approximately .50 of a gallon—.24 for the first coat, .16 for the second, and .12 for the third coat. For light highway bridges they figure that it will require .80 of a gallon for three coats, as follows: .35 for the first coat, .25 for the second coat, and .20 for the third coat. As an illustration of the above table, take a light structure containing 600 tons of metal, to be painted with three coats. It requires .80 of a gallon to coat each ton of this iron three coats. Therefore, 600 times .80 gallons equals 480 gallons for the three coats.

Paint Figures on Structural Iron Work.—The following table, showing the amount of materials of the ordinary kind that are required to make a gallon of paint, and the square yards of surface that can be treated therewith, will be useful to check the statements of firms as to the economy in first cost that would result from the use of their patent or secret process paints.

Paint	Vehicle volume = 1 gallon	Pounds of pigment	Weight and volume of paint	Sq. ft. covered 1st coat	Sq.ft. covered 2d coat
Red lead ..	Lins'd oil	22.4	30.4 = 1.4	630	375
White lead ..	"	25.0	33.0 = 1.7	500	300
Iron oxide ..	"	24.75	32.75 = 2.6	600	350
Graphite ...	"	12.5	20.50 = 2.0	630	375
Asphalt	"	17.5	30.0 = 4.0	500	300

In connection with this table it should be remembered that light structural work will average about 250 sq. ft. to the net ton of metal, and heavy structural work will run about 150 sq. ft. per net ton, while light corrugated steel (No. 20) has 2400 sq. ft. of surface to the ton. Roughly one-half a gallon

of paint per ton of structural steel is required for a first coat, and three-eighths gallon for the second coating, under average conditions.

Time Required for Breaking Up and Mixing 100 Lbs. White Lead

A careful test has shown that a painter can break up and mix into ordinary paint 100 lbs. of white lead in from 30 to 40 minutes. This is allowing for breaking and mixing as described elsewhere, that is, by starting with only a pint or so of oil and adding oil gradually until the mass has become a perfectly smooth mixed paint, ready for straining, which should always be done with any hand-mixed paint. The addition of color will take a few minutes more, according to whether the color is simple, that is, with one pigment, or with two or more.

Certainly an average good painter, one who knows how to mix paint in white and shades, will be able to mix the 100 lbs. of lead into paint within one hour, and this is a liberal and safe estimate.

The consistency of the above white lead paint, that is, one mixed by hand, estimating it to have been mixed with $4\frac{1}{2}$ gallons of oil, or for a priming coat, according to standard specifications, 7 to 9 gallons of oil, with turpentine for inside work, or a little in the outside work, and not less than 5 to 6 gallons of oil for any first-class work, will correspond very closely to the consistency of ready-mixed paint. Putting the two kinds of paint, the hand-mixed and the ready-mixed on the same basis and taking average retail prices for ready-mixed paint, we will have about $1.82 for the hand-mixed paint, as against $2.25 for the ready-mixed paint.

We have no very definite figures to show the cost of mixing paint by hand, but a very close estimate may be made. For instance, to mix up 100-weight of lead into white paint, opening the keg and taking out and beating up the lead, adding the oil and mixing until of proper paint consistency, also adding driers, making about 8 gallons of paint, might take an hour, and some have estimated the time at double this figure. Roughly speaking the cost would be about 8 to 10 cents per gallon. Where the shop keeps a man steadily in it for mixing all the materials, etc., the cost would obviously be less for the hand-made than for the best ready-made paint.

Comparative Cost of Hand-made and Machine-made Paint

"Thoroughly practical mechanics in estimating the amount of white lead and oil to cover a given surface, figure 6 pounds of white lead mixed ready for use, to the square (100 square feet), two coats, and you must admit the leading contracting painters have had opportunities to confirm the correctness of their estimates.

"Accepting this basis, let us do some figuring. You will probably quote:

100 lbs. white lead	$8.00
4½ gals. linseed oil at $1.25.....	5.63
¼ gal. turpentine japan at $1.20....	.30
¼ gal. turpentine at $1.20.....	.30
Or a total of.....	$14.23

for enough paint to cover 16 2-3 squares (1667 sq. feet.) two coats. Each gallon of high-grade prepared paint will cover 3 squares (300 sq. feet), two

coats, or 5½ gallons will cover 16 2-3 squares; and if you will sell such paint for $2.25 per gallon, it would cost your customer $12.38, a saving of $1.85, or 13 per cent. This saving is on white paint; if colors are used, the saving will be more because you must add the cost of tinting colors to white lead and oil.

"Nor is this all; if the consumer mixes his own colors, he must provide the necessary packages, adding to his expense, and possibly suffer considerable annoyance in his attempt to tint his paint to conform to his idea of the shade he wishes to use, and very likely mixing either too much or too little for his job. If a painter is employed to do the work, it goes without saying that the time required by him in mixing and tinting will be charged in the bill, thus considerably increasing the cost of the hand-made paint.

"But prepared paint, already tinted, can be sold at the same price as white. That shows the economy in a machine-made paint, that is, if the right materials are used in making."—*From an article in a paint dealer's publication.*

A Table of the Relative Weight of Pigments

The relative weight of a pigment is the weight of a pigment in its working state, as distinguished from the more scientific figure of specific gravity.

The specific gravity must not be confounded with the relative weight. The specific gravity refers to the material when considered as a solid. The relative weight is the specific gravity of the loose pigment as measured in the market.

The paint maker, having to deal with technical conditions, is more interested to know the actual work-

ing conditions than he is in the theoretical and scientific figures.

We therefore give you below a table showing the relative weights of the more important pigments.

The figures give the number of pounds per gallon contained in a gallon measure, loose weight.

(The relative weight of linseed oil is 7.75 pounds per gallon.)

Asbestine	4
Blanc fixe	13
Barytes	17
Whiting	5¼
Sublimed lead	11
White lead, Dutch process	15
Lampblack	½
Bone black	5
Frankfort black	6
Orange mineral	17
Raw siennas	6½
Burnt siennas	6
Red lead	27
Para reds (average)	8
Zinc yellow	6½
Medium yellow chrome	6½
Orange chrome	12
Vandyke brown	5½
Raw Turkey umber	6
Burnt Turkey umber	4
Pure chrome greens (average)	12
Prussian blue	3
Chinese blue	4
English vermilion	15

What an Average Painter Can Do In One Hour

One square yard of three-coat work, ordinary job.
One square yard of one-coat of flatting or enameling.
Five square yards of washing off and calcimining.
One square yard of oak graining.
One square yard of sizeing and varnish, on wall paper.
One square yard of two-coat varnish or stain, and one coat of varnish.
One yard of cornice with enrichments and ten tints.
Three yards of plain cornice in four tints.
One single roll of medium grade wallpaper hung.—*W. J. Pierce.*

In painting average size outside window blinds I have found that it takes about fifteen minutes to the blind, or four blinds to the hour, or 18 pairs to a nine-hour day. This is a liberal estimate, and a man would have to work very steadily to average that many blinds in the nine hours.

Dark blue reflects 6½ per cent. of the light falling upon it.
Dark green about 10 per cent.
Pale red, a little more than 16 per cent.
Dark yellow, 20 per cent.
Pale blue, 30 per cent.
Pale yellow, 40 per cent.
Pale green, 46½ per cent.
Pale orange, nearly 55 per cent.
And pale white, 70 per cent.

To ascertain the amount of paint required to cover a given surface, on wood, divide the number of square

feet by 200, which will give the number of gallons required for two-coat work. The usual estimate for ready-mixed paint is that a gallon will cover about 500 square feet, average surface, on wood or smooth metal, one coat.

To ascertain the number of pounds of white lead in oil, as it is in the keg, before thinning, required to cover a certain area of square feet, divide the area by 18, which will give the amount of lead required for doing a three-coat job.

It should be borne in mind that all estimates are simply approximate, surface conditions and thinning of paint entering into the problem.

The paint material required for an average dwelling house, excluding glass, will be from 20 to 30 per cent. of the cost of the painting, according to an expert. The difference between the cost of the very best materials and the poor ones is so slight that, excepting, perhaps, in the case of a very large contract, it does not pay to use the latter; reputation is a valuable asset, and hence worth keeping.

A foreman painter for the Pennsylvania Railroad, at a convention of Master Car Painters, said: "The cost of removing paint and varnish with remover is about one-half of what it is to remove with scrapers, as near as we can arrive at it."

He further stated that the average cost of removing paint and varnish from a passenger car by the old method of burning and scraping was $88.60, and that the same work is done with remover for $42.70, a saving of more than one-half. The same proportionate saving follows in any other work.

Colors cost from 10 cents to $6.00 a pound; a good many cost from 50 cents to $2.00 a pound. The rule

is, the more expensive the color is, the more durable, more wear, and more beauty is obtained from it. There is a brightness and color strength which cannot be produced with cheap materials and inferior workmanship.

Quantity of Oil Required for Grinding Pigments

The value of this table, comprising as it does only a part of the total list of pigments used by the paint makers, lies in the fact that the painter is enabled to tells something about the comparative values of different pigments used by him for the amount of oil taken up by a pigment indicates its wearing qualities, one that takes very little oil not wearing as well as the one which requires considerable oil to prepare it for use. Thus, where lampblack will require a gallon of oil to one-quarter pound of pigment, the same amount of oil will do for from 32 to 100 pounds of ordinary white lead. We all know how durable lampblack or carbon paint is, as compared with white lead paint. White lead signs lettered with lampblack or ivory black may be seen where the white lead has entirely worn away, while the letters are still in fair condition. Of course, carbon is nearly indestructible by the weather, while white lead is easily acted upon.

Dry Pigment.	Per cent. of Oil Required
White lead, ordinary, Dutch process	9
" " sublimed or sulphate	10
Zinc white, American	16
Blanc Fixe, barium sulphate	30
Barytes, natural barium sulphate	9
Whiting	20
Gypsum	22

Silica, fine floated	26
China clay	28
Asbestine	32
Lithopone	12
Chrome yellow, lemon shade	23
" " medium shade	30
" " orange	20
" " deep orange	15
French yellow ochre	28
American yellow ochre	26
Oxide of iron	25
Venetian red	23
Tuscan red	27
Turkey red	28
Rose pink	55
Red lead	25
Indian red, iron oxide, 98 per cent. pure	20
American vermilion, chrome red	16
English vermilion, sulph. of mercury	14
Chrome green, light, chemically pure	21
" " dark, chemically pure	25
Raw sienna, Italian	52
" " American	45
Burnt sienna, Italian	45
Raw umber, Turkey	48
" " American	38
Burnt umber, Turkey	47
" " American	36
Vandyke brown	50
Mineral brown	24
Prussian or Chinese blue	50
Ultramarine blue	27
Carbon black, gas black	82
Lampblack	72
Ivory drop black	60

Bone black 50
Graphite or plumbago, pure 40

The number of pounds of dry pigment to be ground with a gallon of oil may be determined by multiplying the weight of a gallon of oil by 100, and dividing by any of the above percentages. Assuming the weight of the linseed oil to be 7.75 pounds per gallon, and multiplying by 100, we have 775, which, divided by any of the above percentages, gives the required number of pounds of dry pigment for the mix. Thus, for graphite, 775 ÷ 40 per cent. = 19.375 pounds of dry pigment per gallon of oil.—*R. S. Perry.*

Regarding the amount of oil required in the grinding to paste form of the different pigments used by painters, I find a wide difference in figures given by various authorities. Thus, while one gives for medium chrome yellow 30 per cent., another gives only 26 per cent. Here is a table showing the amount or percentage of oil in pigments in paste form, taking but a few such:

Rose pink	30 to 35
Carmine, French	50 to 55
Vermilion, American	20 to 22
" English	15 to 18
" artificial	15 to 30
Chrome yellow, light.....	20
" " medium	26
" " orange	22
Yellow lake, French	38

Amount of Oil Required When Grinding Pigments

Name of Pigment	Dry Pigment Required for Grinding One Gallon of Raw Linseed Oil			
Barytes	31	to	106	lbs.
" precipitated	16	to	56	"
Zinc oxide, precipitated	8	to	65	"
" " selected	16	to	68	"
Lithopone	23	to	87	"
Sublimated white lead	28	to	112	"
Lead sulphate	26	to	105	"
White lead, Dutch process	40	to	135	"
" " quick process	38	to	125	"
Yellow ochre, Oxford ochre	15	to	30	"
C. P. chrome green, light	30	to	47	"
Venetian red, dark	18	to	40	"
Indian red	21	to	50	"
Purple oxide	20	to	62	"
Orange mineral	33	to	101	"
Red lead	43	to	147	"
English vermilion	38	to	77	"
Golden ochre	25	to	50	"
Naples yellow	37	to	65	"
Chrome yellow, light	18	to	56	"
" " medium	16	to	37	"
" " orange	27	to	52	"
Litharge	83	to	150	"
Emerald green, genuine	23	to	36	"
Raw sienna, Italian	8	to	21	"
Burnt sienna, Italian	8	to	21½	"
Raw umber, Turkey	7	to	22	"
Burnt umber, Turkey	6	to	23	"
" " American	6	to	31	"
Prussian blue	3½	to	18	"
Bone black	7½	to	22	"

MARINE PAINTING

ED LEAD FOR IRON VESSELS.—The painting of ships' bottoms, or of any marine metal work, has long had the study of scientific men, and the general consensus of opinion among such is that for iron that has to be under water all the time nothing is so good as red lead mixed in boiled linseed oil, followed by some varnish paint. An oil paint that will stand the test on glass under water has been shown to have no protective value on iron under water. Salt water, such as sea water, according to Andes, is less injurious to oil paints than fresh water. Some think raw oil better than boiled oil for mixing with red lead for this purpose.

A navy yard master painter says that red lead is most generally employed by the Government for iron work, and he believes that nothing equals it for iron, both below and above water, provided one can get pure raw linseed oil.

A good paint for iron, steel, or otherwise covered parts of ships exposed to the water shall, in addition to preserving the material generally, serve the purpose of preventing the known injurious effects of accumulations of sea animals and algæ. This is obtained by a closely adhering, smooth coating, which contains, mixed with it, poisonous substances that kill the plants, mollusks, and other organic formations that attach themselves to the ship's hull, and which also possess the property of peeling off in a thin layer where the dead organisms are situated, without exposing the hull of the ship.

There are many elaborate compositions calculated to effect this object, yet it must be acknowledged that to date there is no absolutely sure anti-fouling paint.

MARINE PUTTY.—The best putty for boats below the water line is made as follows: Four pounds of burnt umber is boiled in seven and one-half pounds of linseed oil (one gallon) for two hours, then two ounces of yellow beeswax is added and well stirred in. When dissolved, take from fire and allow to become lukewarm, then stir in and mix thoroughly with it eleven pounds of powdered chalk and two pounds of powdered white lead. Knead the mixture, using more chalk or whiting until the right consistency. Keep in water to avoid getting hard.

Whiting	15 lbs.
Portland cement	10 "
Sublimed white lead	10 "
Litharge	5 "
Raw linseed oil	1 gal.

This putty will harden under water.

REFINISHING HARDWOOD DECK.—To get the best results, clean off the deck and apply a good varnish remover. After getting the surface clean, mix a saturated solution of oxalic acid, and make it hot; apply with a rag swab. This will remove any stains, spots, etc., and bleach the wood. Apply a coat of wood filler. When dry, sandpaper, dust off, and apply a coat of best spar varnish. After two days apply a second coat of spar varnish.

A paint that has given excellent results when used on the interiors of trimming tanks of submarines is made of a graphite pigment and an asphaltic oil thin-

ned with benzine. This paint has displayed remarkable protective qualities when used under the trying conditions mentioned above, and its cost is less than one dollar a gallon. Red lead, which costs not far from two dollars a gallon, though used generally for the purpose mentioned does not give results that are even satisfactory, due to the fact that linseed oil films do not exclude water, and red lead paint made with linseed oil will not adhere properly to a surface that has the slightest trace of moisture.

Another paint that has been used extensively at the Brooklyn Navy Yard for uses to which red lead has been put, is composed of a pigment similar to Venetian red, containing iron oxide, calcium sulphate and silica, and of specially high quality of linseed oil, turpentine and driers. The merit of this paint appears to be due to the special quality of the linseed oil and the care used in manufacture, and, though it is somewhat more expensive than the others mentioned, the paint is much cheaper than red lead, and appears to be more effective.

Cork Varnish for Ships.—In order to protect the interior of ships from the humidity caused by condensation upon the metallic walls during sudden changes of temperature, the Italian marine has experimented with a kind of hygroscopic varnish, or coating, the essential compound of which is ground cork, which is consolidated by pressure with copal and litharge, applied to the walls. It has been found that the cork varnish absorbs the watery vapor of the atmosphere to the extent of eight or nine grammes for every square meter of surface exposed.—*Scientific American.*

PAINT FOR YACHTS.—For the white enameled yachts, top strokes and combings, the work should be primed with pure lead, mixed with equal parts of boiled and raw oil, following with two coats pure zinc oxide mixed in two parts boiled oil, three parts copal varnish and a little patent driers. After thoroughly hardened, it should be given two coats of finest carriage or copal varnish. The best protection for iron fittings is red lead mixed with boiled oil, which may be finished with a less conspicuous color, as red oxide or Indian red.

BOILED OIL.—It is said that ship painters will never use boiled oil in a paint that is to be subjected to hard usage or jarring, for they claim that it will break clear to the wood. They, of course, prefer raw oil for all purposes.

Following are some of the formulas in use on war vessels:

WHITE FOR OUTSIDE WORK.

This paint is intended for such parts of a ship as are exposed to the weather. The following formulas are for the production of one gallon of paint for first coat:

Formula No. 1

White lead, in oil	7 lbs.
Zinc white, in oil	7 "
Raw linseed oil	½ gal.
Turpentine	2 gills
Japan drier	1 gill

Formula No. 2.

White lead, in oil	5 lbs.
Zinc white, in oil	9 "
Raw linseed oil	3 pints
Turpentine	4 gills
Japan drier	1 gill

White for Inside Work

This is intended for use in store rooms, magazines, etc., and the following proportions produce one gallon of paint:

White lead, in oil	7 lbs.
Zinc white, in oil	7 "
Raw linseed oil	1 qt.
Turpentine	1 "
Japan drier	1 gill

Flat White.

This is intended for inside work in such places as officers' quarters. The following proportions make one gallon:

French zinc, in oil	8 lbs.
White lead, in oil	9 "
Turpentine	3 pts.
Raw linseed oil	1 gill
Japan drier	½ "

Formula No. 2 (Finishing Coat).

French Zinc, in oil	17 lbs.
Turpentine	3 pts.
Patent driers (mixed thin)	½ gill

White Enamel or Gloss White

Formula No. 1, for one gallon

French zinc, in varnish	8 lbs.
Dammar varnish	5 pts.
Patent driers	$\frac{1}{4}$ gill.

Formula No. 2, for one gallon

French zinc, in varnish	$4\frac{1}{2}$ lbs.
Dammar varnish	$6\frac{1}{2}$ pts.
Patent driers	$\frac{1}{4}$ gill

Spar Color

This paint is for spars, davits, smokestacks, ventilators, etc. The following proportions produce one gallon:

White lead, in oil	$16\frac{1}{2}$ lbs.
French yellow ochre, in oil	$1\frac{1}{2}$ "
Venetian red, in oil	$\frac{3}{4}$ oz.
Raw linseed oil	$\frac{1}{2}$ gal.
Turpentine	1 gill
Japan drier	1 gill

Oxide Paint for Boat Topping

This paint is intended for use on waterways, inner bottoms and all spaces where a quick drying paint is necessary. The ingredients are to be mixed and ground together in a mill. The following produces one gallon of paint:

Venetian red	5 lbs.
Spar varnish	3 pts.
Japan drier	2-5 gal.

Paint for Torpedo Boats and Torpedo Boat Destroyers

The color of this paint is bottle green. The following proportions produce 25 gallons:

White lead, in oil	200 lbs.
Med. chrome yellow, in oil	15 "
Lampblack, in oil	15 "
Raw linseed oil	10 gals.
Turpentine	2 "
Japan drier	2 "

Boat Painting.—An expert boat painter gives the following method for painting a new boat: Sandpaper smooth and prime with white lead thinned with oil, raw, three parts, and turpentine two parts, with one part white liquid drier, for a white job. If to be done in any color, then tint the priming to suit the color. If the exterior is to be green, then make a lead color primer. Allow several days to elapse before applying the next coat. A week, if possible. Second coat, if white job, mix equal parts of pure lead and zinc white in oil, to be tinted with an oil color if the finish is to be in color. Thin with turpentine and a little drier, so that it will dry nearly flat, and allow several days to harden. Then sandpaper. For white finish thin a good grade of zinc white in oil with a first-class exterior or spar varnish, of fairly pale color, to a flowing consistency. For colored work, add to this before adding the varnish, the desired coloring. Do not flow it on, but brush out evenly and not too heavy. If the hull is to be green or any other solid color, thin the oil color for the second coat, also, so it will dry flat, and add spar varnish for the finishing coat.

To re-paint a boat, scrape off all loose paint and let remain any paint that is in good condition; the keel will probably require entire repainting, but the other bare parts may be touched up, and when dry, sandpaper the entire surface and apply a coat of paint that gives an egg-shell gloss, after which a finish as described for a new boat may be given.

Painting Canvas Boat.—Mix 7 lbs. white lead ground in oil, and 3 lbs. whiting thinned to a stiff paste with boiled oil, adding an ounce of common yellow soap, dissolved in one-half pint of water; apply this to the canvas in a heavy coat, and when it has set, but before too dry, scrape away with a knife or wide-bladed spatula, excess paint, leaving the canvas well-filled as to its texture. Let dry, then give it another coating of the same paint, a little thinner, and when dry, sandpaper smooth and finish with any desired color of paint, mixed in oil.

The method used in the British navy yards is similar to the above: Eight lbs. best yellow ochre ground in oil, boiled, and 1 lb. of lampblack, in boiled oil, are mixed, making a paint with a verk dark green hue. To this add one ounce of yellow soap dissolved in hot water, one-half pint. Apply stiff, and allow three days for drying. Then make up a similar paint, omitting the soap, and adding a larger proportion of boiled oil, which should dry free from tack in three days. After this any oil paint of any desired color may be applied. The first two coats make the canvas waterproof and keeps it from rotting or cracking. In order to get the best wearing job, avoid inferior materials, especially oil, turpentine, and varnish.

Putty for Boats.—The best putty for boats for use below the water line is made on the following

formula: Four pounds of burnt umber is boiled in $7\frac{1}{2}$ pounds of raw linseed oil, this being equivalent to one gallon. Boil for two hours, then add two ounces of beeswax and stir well. When dissolved take from fire and allow to become lukewarm, then stir in and mix thoroughly with it 11 pounds of whiting and 2 pounds of dry white lead. Knead the mass well, and add more whiting if necessary. Keep in water when not needed.

The United States navy, after long experimentation, painted a large part of its fleet with pigment composed of 45 per. cent. zinc oxide, 45 per cent. blanc fixe (artificial sulphate of barium), 5 per cent. of lampblack, and 5 per cent. of graphite. This was mixed with the proper linseed oil and driers, and it was found to cost one-third less than the old lead and zinc paint which the navy formerly used, and gave not only a better looking paint, but one that held its gloss longer, and was not acted upon by salt water.

Steel-covered boats, fresh water, painted below water-line with red lead and zinc white, half and half, always stood.

GLAZING SASH

A PAINTER writes to ask whether the flat or crown side should go out. The flat side fits snug against the muntin, and the reverse is the crown or convex side, and if one is not careful in fastening down the glass, with the crown side down, there is danger of breaking it, while with the flat side down there is no danger. Moreover, by having the flat side out, objects viewed from the inside appear normal, while with the convex side in objects are more or less distorted.

Fasten the pane of glass securely, so that it cannot move around; if the pane is too small for the opening, particularly if too short, the pane will slide and cause a shrinking of the putty, which is an eyesore. Drive the sprig or point far enough in to be out of the way of the putty knife when glazing, but not far enough to miss the edge of the glass. Use a sharp chisel for driving, or get one of these new drivers. Lose no time in placing the lights of glass; if one light is too large, pick up the next, and so on until you get one that will fit; often the lights are not cut correctly. At any rate, if none will fit, better cut a piece off the glass, rather than cut some of the muntin away, as many do.

At the factory they dip the sash into rosin or gloss oil, before glazing. The result is that no putty will stay on it. Raw linseed oil with a very little driers in it, and with a little white lead or none, as you please, will do. The advantage of oiling, rather than

painting, is in the fact that if you are to finish the inside natural, you can do so, no paint being on the inside of the sash, and the oil priming does just as well as white lead priming. Of course, if the inside, too, is to be painted, we would prefer to prime the sash with lead paint.

To glaze rapidly one needs considerable more practice than the average painter gets, but at the same time he can be fast or slow, according to his bent. A ten-year-old boy at the factory would make the ordinary painter look like a canal boat compared with an ocean liner, in the matter of glazing. But factory work is seldom done right. I have known painters, even some master painters, who absolutely could not glaze at all, not knowing how to hold the putty and feed it out under the knife.

Here are some hints: Never handle a sash oftener than is necessary; run your putty to a finish in each corner; make one move across the muntin, finishing as you go. To begin with, drop each light of glass into its place quickly, holding a lot of lights in the left hand, while you deal them out with the right hand. The sash has been lying on the table; when lights are all in, prop the sash up on the table, using a block of wood about four inches high, on the side farthest away from you; remove the glass as with both hands you bed the sash with putty, puttying with the thumb against the muntin. When done, drop the sash on the table, taking the block away, and replace the glass evenly and firmly on the bedded muntins. Put in the points with a stripping machine or magnetized hammer; then put on the glazing putty in the same way you did the bedding putty, using both hands together. Then trim off the putty with the putty knife, holding it firmly at the proper angle with the sash.

Turn over the sash and remove the surplus back putty. Stand the sash among those already done, and swish some clear, cold water, with a little lime in it, over the glass, using a duster to do it with, this removing the nibs of putty and grease marks. It is done.

The factory priming of sash I have mentioned, but might add that they use Venetian red or burnt sienna, or whiting, as may be desired, and according to what the finish is to be. These colors are dry and thinned with glue size, or at best, rosin oil or benzine. The putty they use is the worst the paint maker's chemist has yet succeeded in producing.

In the shop priming of sash, oil stain or paint may be used, as previously pointed out, and we would include the rabbets of the windows in the priming; allow the priming to dry perfectly before glazing. This will prevent the absorption of the oil from the putty by the wood. For a hurry job, prime sash inside and out with either boiled oil or raw oil and a little japan. This will dry much faster than lead priming.

For glazing small lights rapidly try this method of bedding them: On a glass slab roll out some putty with a glass rolling pin, like dough, the thickness depending upon the amount of putty required. Take up the putty with an edge of the glass, filling all four edges this way, then drop the glass into its place and press down. Drive in points and glaze.

If a light is rather small for the place it is to fill, secure it in place by driving a point under an edge, to hold it up, the point to be at right angles with the light.

In removing old glass it sometimes pays to take the whole sash out, which may be done by unfastening the pulleys.

PAINT SPOTS ON GLASS.—These may be removed by rubbing off with the edge of a silver coin, or a bronze penny, neither of which will scratch the glass. Or, dampen a rag with paint remover or benzol, and the spots will soon soften and come off on the rag.

WHAT IS A GOOD DAY'S WORK GLAZING SMALL PANES? Say size 9x12. *The Painters' Magazine* says that on new and primed window sash with glass of this size a man should put in 100 lights per day of 10 hours, or 10 lights per hour. This is a rather modest estimate, we think. Scott (*White Paints and Painting Materials*), "a pound of putty is estimated to run 20 feet of rabbet on regular sash, and 15 feet on large rabbets. In the sash factories the boys do 60 sash, containing nine lights 8x10. This is equivalent to 1620 feet of rabbet, and should take about 81 lbs. of putty, including waste." This would be 540 lights a day.

It should be remembered, however, that an expert, even a boy, who does nothing, day in and out, but glaze new sash, will do very much more in a day than the painter who works only occasionally at it.

REMOVING GLASS FROM OLD SASH.—A painter says he removes panes of glass from old sash with a torch with the flame about one-half on, and he has removed 100 at a time this way and never a one cracked. Use a small torch.

GLAZING SASH.—It is best to bed all glass, but not always feasible, on account of cost. Glass and sash rarely fit neatly, and when this occurs it is well to sprig the glass so that when turned down or around

in handling it will not cause the glass to slide and make wrinkles in the putty. Bedding is good where there is much crown to the glass, for in sprigging it down there is danger of breakage. A well-glazed sash is easier to paint than the other kind.

Glazing a Skylight.—The following idea is from the Australian *Painter and Decorator*: It is a habit of glazed skylights to let water through at times, owing to defects in the puttying, and the method here given has been used for six years on flat and sloping lights, and without a single failure: First, well prepare, stop, and paint skylight, one coat, using stopping while paint is wet. When dry, take new fine linen and cut to width so that it will cover bar and glass on either side of frame to the extent of $\frac{1}{8}$ inch. Then well paint bar and strip of linen, and lay on same in wet paint, taking care to start at bottom and work up, well rubbing out creases. When well dry, give finishing coat.

Putty Inside or Outside on Sash Door?—This is a question for a carpenter to answer. He usually hangs such a door with the putty outside, so that it will be like the windows. But some carpenters place the putty inside, saying that the door looks better that way, and we think it does. It would depend somewhat upon the character of the door, and location. The putty will protect the sash from the rain, which would spoil the wood itself. Then, as we have already stated, the work looks better in some cases with the putty inside, where it is not so conspicuous. The putty is for holding the glass in, but more for preserving the wood from the weather. We would say, leave the sash door with

putty in or out, just as you found it when beginning the job.

Slight Scratches on Window Glass.—These may often be removed by rubbing with a pad of raw cotton charged with jewelers' rouge powder.

Scratches on Plate Glass.—If not deep, they may be removed by rubbing with a powder made of powdered chalk, 60 parts; tripoli, 30 parts; bole, 15 parts; reduce to a fine powder and mix; wet the scratched place with water, then dip a linen cloth in the powder and rub, repeating until the scratch is gone. If a deep scratch, it will have to be ground out with the finest flour emery, such as opticians use, and the spot polished with rouge and water upon a piece of soft leather; or grind scratch out with a buff wheel of wood, fine pumice stone and water.

Iron Stains on Window Glass.—The rusting of wire screens often cause iron stains on window glass that are found very difficult of removal. To remove them mix up 30 parts water, 7 parts hydrochloric (muriatic) acid and a few drops of iodine. Wet a rag with the mixture and rub the spots until they disappear. Then polish the glass with a clean, dry cotton cloth.

Coating Skylights.—Whiting, 13 ozs.; ultramarine blue, 100 to 120 grs.; gelatine, 1½ ozs.; water, 24 ozs. To which is added, when mixed: glycerine, 1½ ozs.; starch, ½ oz.; boiled in 10 ozs. water. After all is dissolved, brush it on the glass with a 3-inch flat paint brush. Warm the solution every time you move the ladder, and stir it. Add water a little at a

time as the solution is used, as it will gradually get thicker. The best effect can be produced by using the solution quite warm, and when the sun shines on the skylight. The coating can be easily removed with a sponge at the beginning of winter or in the spring before recoating.

PUTTY MARKS ON GROUND GLASS.—"In glazing glass I am troubled with the putty making a stain that is hard to remove, and I would like to know how this work is done so that the job will come out clear and clean." The putty may be removed by means of an alkali, concentrated lye will do, using a stick with a rag on the end, and applying the caustic to the putty, which will soon disappear, after which wash off with clear water. But it is easy to prevent the trouble by rubbing soap over that part of the glass liable to get some putty on it. It is difficult to clean up the glass when the putty gets on, but by rubbing with soap you can use water on it after glazing and the soap will cause the oil or putty to fade away. Another very good plan is to rub the glass with the cut side of a raw potato, leaving it to dry, and then glaze. The potato leaves a film of starch, preventing the oil or putty from lodging on the glass.

Window glass exposed to the heat and cold and varying winds will, after a number of years, become so brittle that it can be cut with a pair of shears. It is said that light and darkness have different effects on glass, and this alternation alone will cause it to become fragile and in time worthless.

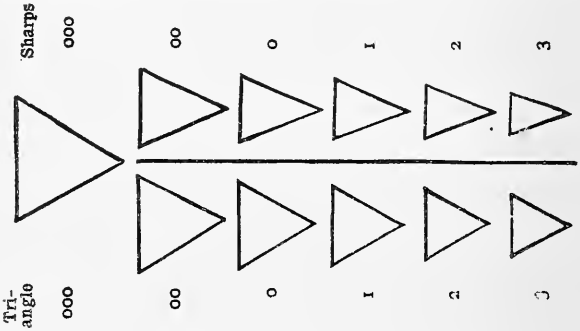
It is almost impossible to remove old windows from a building without breaking many of the panes of glass. New glass can be handled with much more carelessness.

There is a certain elasticity about new glass that leaves glass which has faced the weather for a number of years.

Street fakers who travel throughout the country selling scissors will obtain a lot of old window glass and show the crowds how wonderfully their shears will cut by clipping off strips of the glass just as a person would cut paper, when in fact the feat is due to the fact that the glass is actually rotten.

Tools Used by Glaziers and Glass Cutters

Glazier's Points.—In the early days of the art glaziers cut points from tin, and those taken from very ancient window sash are quite tiny. Later on points became a factory-made article, zinc being used for the purpose, just as now. Old painters can re-



member calling these useful little bits of zinc "sprigs," and some call them still by that name. Glaziers' points come in several sizes, as 3, 2, 1, 00, 000, the No. 3 being the smallest, and No. 000 the largest. They come in small paper boxes holding $\frac{1}{4}$ and $\frac{1}{2}$ pounds each. The $\frac{1}{2}$ pound packages contain all sizes, and are sold wholesale in boxes containing 100

papers. The $\frac{1}{4}$ pound packages contain Nos. 0 1 and 2 only. They are packed for the trade in 200 paper boxes.

There are double-pointed points for greenhouse and hot-bed use. Sizes Nos. 1, 2 and $2\frac{1}{2}$, each box containing 1000 points. This refers to Van Reypers' points.

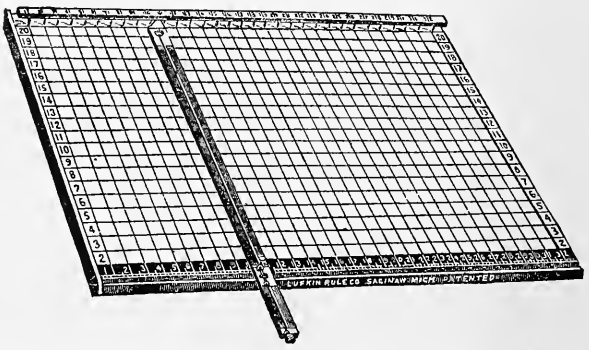
There are various tools for driving points. One hammer has a rotary head, this head being triangular in shape, with faces adapted for different sizes of points. The fact that this head is rotary, or movable, enables you to hold the handle at any angle, while the head is flat against the glass. The other end is made of malleable iron in the shape of a hammer, useful for hammer purposes. The tool is nickel-plated, the angular head being made of tool steel. This tool is useful for picture frame makers as well as for glaziers, and with care should last a lifetime. It is Pitt's patent. It sells for about 60 cents. Another style hammer sells for about 70 cents.

Hacking Knife.—The hacking knife is designed for removing old putty from window sashes, with the accompaniment of a hammer. The blades are hand-forged, the handles of leather, firmly riveted. They should last a lifetime. In sizes they come $3\frac{1}{2}$, 4, and $4\frac{1}{4}$ inches long, and about $1\frac{1}{8}$ inches wide, and $\frac{1}{8}$ inch thick. There are knives for light and heavy hacking.

Putty Knives.—These come in various styles, at different prices, according to quality of steel and degree of finish, etc. There are both stiff and elastic blades, square and diagonal of point, and double pointed or diamond shape. The blades are about

four inches long, some being a little longer than this. There is also a trowel putty knife, and glazing knives, and half-elastic wide putty knives, the latter useful for following the torch in burning off old paint. The blade is about the width of the flame, or two inches, the length being nearly four inches. There may also be mentioned "filling knives," putty knives of rather wider dimensions than the regular glazing knife, and somewhat longer. They are elastic.

Glass-boards are for cutting glass upon, being marked off into inches and fractions on all sides, with



ruled lines across the board both ways. A guide rule comes with it, and it is made so as not to warp, swell or shrink, making a perfect surface for cutting lights of glass upon. The straight edge cannot slip while cutting, and one board has illuminated figures so that it is easy to cut in a dim light, as where the cutting is done in a dark part of the shop or store, or on a dark day. Every shop should have such a board, for many a light is broken owing to the uneven surface the cutting is done on, saying nothing of

an inexperienced hand. With the glass board, the most inexperienced painter can cut safely and correctly, and rapidly as well.

There are several makes, one of which sells at about $9.00, the size being 30 by 48 inches.

Glazier's Rules.—These are brass-capped on ends, and are 3, 4, 5 and 6 feet in length. Prices range from about $1.25 to $2.75 each, according to length.

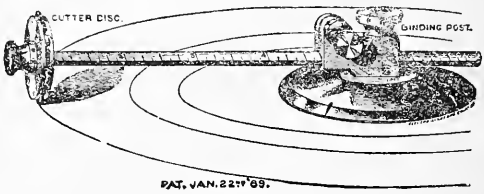
Plate Glass Cutters' Rules are brass-capped on the ends, and come in two lengths, 7 and 8 feet. The prices are about $10 and $12 each.

Plate Glass Rollers.—This is a sort of pliers, intended and used for breaking away edges of plate glass. One eleven inches long will cost about $1.50.

Plate Glass Pliers.—This tool has a wide jaw, made for breaking off strips of plate glass after it has been cut with the diamond. A ten-inch tool costs $1.50.

Steel Wheel Glass Cutters.—These are deservedly popular for ordinary glaziers' use, as they make a good cut, when new, and are very cheap, so that it is economy to use them for occasional and common work in preference to a real diamond, one misuse of which may put it out of commission. These tools come in various styles, some with a single disk or wheel, while others contain several, in what is called a magazine. In price they range from about 8 cents each up to about 20 cents. It helps, when using these tools, to wet the wheel with turpentine, or even with the mouth.

Steel Wheel Rotary Glass Cutter.—This tool is for cutting glass in circular shapes. The cutter disk contains six hardened steel wheels, which can be renewed as they wear out. They cost about $3.00 each.



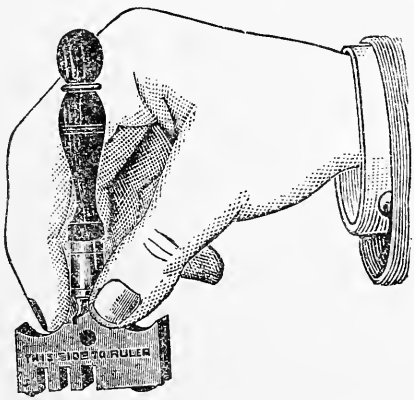
Cutter for Plate Glass Factory Use.—This tool is quite different in form from any other, and is intended only for factory use. In shape it may be said to resemble a rubber stamp. It costs about $15.

Glazier's Diamonds.—These are for ordinary glaziers' or painters' use, and may be had in different sizes, with a diamond point in size according to price. One cutting single thick window glass will cost $5.00. One a little heavier and made for cutting double thick glass will cost $6.50. Another, made for cutting double thick glass, with a still larger diamond, will cost $10. Every diamond used or placed in one of these cutters is tested by an expert before leaving the store, hence dealers will not take one back or exchange one. Hence, it is well to test one before paying for it or leaving the store. If unaccustomed to using a diamond it is well to get some instructions from the dealer. There is a certain way to hold the tool and to bear on and cut. The best diamond can be ruined at the first cut, if the man is inexpert or careless. Diamonds can be reset, when worn or dam-

aged. Remember that you should never run the diamond twice in the same cut.

It may be added that glaziers' diamonds may be bought for less than $5.00, or as low as $3.50, but it is best to pay at least $5.00 for one.

THE UNIVERSAL GLASS CUTTER.—It is very easy to cut with this popular tool, as it is set squarely on the glass, and needs only to be pushed along the gauge to insure a clean cut. It has a diamond point,



with one size for cutting single strength glass, and another for double strength. It is handy for carrying in the pocket, has a full size key for breaking off, and is suitable for use on any ordinary glass. They cost $3.00 and $4.00 each, according to size.

CIRCULAR CUTTING MACHINE.—This cuts with a diamond point, coming in two sizes, the smaller one having a cutting capacity of from $\frac{1}{4}$ inch to 6 inches, while the larger machine cuts from 1 inch to 14 inches. They cost $16 and $22 respectively.

Circle Extending Rod.—This machine can be adjusted to cut 6 to 96 inches, having an extending rod, the cutting being done with a diamond point.

Concerning Window Glass

The ordinary jobber's stock of American window glass consists of about 75 per cent. "B" quality, and 25 per cent. "A," and of about the same proportions in single and double thickness. The usual building specifications fall within these limits.

The only choice in thickness in American window glass is between American single, which averages one-tenth of an inch in thickness, weighs about 20 ounces per square foot, and is safe to use against ordinary wind pressure in sizes up to 28x34 inches, and double strength glass, about one-seventh inch thick, requiring a counterbalance of 26 ounces to the square foot, and procurable up to sizes whose sum makes 120 inches; that is, 60x60 inches, 40x80 inches, or anything within these limits. It is hardly safe to use double strength window glass above 40x44 inches in exposed situations or in movable sash. If it is desired to economize on the cost of plate glass in a front, the larger sizes of double strength window glass may be used, but only in stationary lights and in protected situations.

The difference in cost between "A" and "B" qualities throughout the lists will be found to average about 10 per cent. for ordinary sizes in single thickness, with more in the larger sizes and for double thickness. It is allowable for "B" quality to contain, in a minor degree, some of the lesser faults incident to its manufacture, *i.e.*, "cords" or "strings,"

small blisters, either from melting or caused by the workmanship, small burnt patches; that is, where carbon from the gas flame of the flattening oven has adhered to the sheet. It should never be passed if any of these defects are too pronounced, nor if the sheet contains stone, surface cords, furnace scratches, pipe blisters, or is improperly flattened; nor if, as sometimes happens, small broken pieces of glass have become attached to the surface. These fragments usually refuse to come off, and besides their unsightliness, are a source of danger to the cleaner.

In buildings where clear lighting is of no importance, the "C" quality, or "O.B." machine brand will save one cent a square foot, but the buyer must be prepared to pass any defects in glass except "stones." By this is meant pieces of foreign matter, clay from pots and tanks of material not thoroughly crushed; such blemishes are not permissible, because under stress and unequal weather conditions they are almost sure to crack the sheet and necessitate replacement. For ordinary mill, warehouse and cheaper household construction, "B" quality is usually specified, keeping in mind that the smaller the size the less the price for the glass, though not, of course, for the sash construction.

The ordinary "A" glass of commerce is the highest quality the factory produces above "B," very little selecting being done above the former. If "AA" is ordered from a jobber, he will open a few boxes of "A" and select therefrom such sheets as he thinks will pass inspection. In "A" glass no cords of any kind should be passed, no stones, no gatherers' blisters, except the occasional small "blib" caused by the melting or very fine dust blisters, nor any glass that is wavy enough to distort vision.

In specifying any quality and thickness of American glass it is well to require a tank-made, hand-blown, natural-gas and dipped brand.

Hand-blown glass is to be preferred to machine-drawn because of its greater reliability in withstanding the strain due to changes of temperature. Machine-drawn glass cylinders were first made by one John Lubbers, of Pittsburgh, in 1895, and though at first very inferior in quality, have recently been much improved. They are not desirable, however, when a thoroughly reliable article is called for. Tank-made glass is to be preferred to that melted in pots, inasmuch as it is made with a salt-cake base and not liable, like the pot-melted, to fade in the course of time. Dipped glass means that the sheets, hot from the lehr, are dipped in hot water and acid, removing from them all traces of sulphur stain. Glass made with natural gas is to be preferred, because it carries no excess of carbon, it is not likely to be burnt; that is, have the small particles of unburnt carbon adhere to the surface of the sheet.

The next step in quality from American is the so-called French, which is usually Belgian-made, and runs fully 25 per cent. better than corresponding American qualities, though it is lighter in weight than the corresponding grade of the American, the single being usually about one-tenth inch thick and weighing 17 ounces to the square foot, the double, about one-eighth inch thick, and weighing 21 ounces. In small sizes, up to 10x15 inches, the French glass usually sells in New York at the same price as the American, and the difference is not very great up to 16x24 inches. Above this freight charges, breakage and tariff make a difference of four or five cents per square foot.

If the very best blown glass is desired, the English must be specified. This is rated by weights per ounce to the square foot, and the 21 and 26-ounce qualities are most frequently used. English glass may be readily mistaken for plate glass, as it contains almost no waves and no defects except an occasional very small blister. In moderate-sized sheets it is generally about 2 cents per square foot.

As to plate glass, there is little to say, American glazing-quality plate being the usual specification. If a better grade is desired, "silvering" quality may be called for, and if the best, "French silvering," this last being as near perfect a glass as is produced commercially. It is almost silver white, whereas American plate is usually a little green in color. It is procurable any size and thickness for special purposes; the usual glazing thickness is about one-fourth of an inch and weighs three and one-half pounds per square foot. The only defects apt to be found in plate glass are bubbles, and occasionally a gray spot where the polishing is not perfect. An excess of any of these imperfections is sufficient cause for rejection.

Common window glass is made from silica, soda and lime. Crown glass is of a higher variety of window glass, being produced by a different manipulation of the blow pipe. It is of greater luster and beauty, yet as only small panes can be cut from a sheet, it is superceded by other products. Plate glass is made from sand, soda, lime, arsenic and charcoal, and is formed by casting and rolling on a table; there is much waste in the grinding, and the entire process is very expensive.

PUTTY

OMMERCIAL PUTTY.—The formulas used for the commercial manufacture of glazing putty are approximately correct, and near enough for practical purposes, so that the putty maker can use his judgment, something depending on the physical character of the ingredients used; the finer the whiting, for instance, the less is required. For the very best putty, 42 lbs. of gilders' bolted whiting to the gallon of raw linseed oil, is used. With what is called commercial whiting, a coarser material, 50 lbs. of whiting to the gallon of oil may be used, or perhaps rather less than 50 lbs. Foots, for the oil settings, are used in some putties, and as this is thicker than raw oil it permits the use of less whiting. About 3 parts foots to 5 parts raw oil is about the proportion used in this grade. Sash putty is what the sash factories use for glazing, and it is composed of 70 lbs. commercial whiting, 30 lbs. marble dust, 1 gal. raw linseed oil, and 1 gal. foots. Foots weighs $\frac{1}{4}$ lb. more to the gallon than raw oil. A still cheaper putty is made from equal parts of commercial whiting and marble dust. The thinners are the same as in the other formula, a gallon each of raw oil and foots. The foots is a great help in such putties, owing to its varnish-like body. Skylight putty is made of 75 lbs. gilders' whiting, 25 lbs. dry white lead, 5 lbs. fine silica, 5 lbs. litharge or red lead, and 2 gals. raw oil. This is for filling or bedding.

What Scott calls "mail order" putty is about the limit of cheap putties, and is made upon this formula:

50 lbs. of commercial whiting, 30 lbs. marble dust, 1 gal. boiled oil, and 1 gal. 28° parafine oil. Such a putty will soon peel from the sash, and will also rot when the rain and sun get at it.

SHOP-MADE PUTTY.—For a first-class putty, made in the shop, here is one of the best formulas known: Break up 2 lbs. keg white lead in one quart of raw oil, then add 10 lbs. best gilders' whiting, slowly, stirring well until the mass is well mixed, then work it with the hands, on a board, adding whiting as required.

To make putty on a larger scale, and for general use, place in a barrel 100 lbs. best whiting, and pour on top of it 18 lbs. raw linseed oil; the raw oil weighs $7\frac{3}{4}$ lbs. to the gallon. After some hours the oil will have permeated the whiting, forming a sticky mass. Keep the barrel covered, and when needed for use, take a lump out and work it with whiting to the proper firmness. This is a very elastic putty, not hardening perfectly in less than three years, and in some cases may not harden in double that time. Being very sticky when taken from the mass, it needs to be thoroughly well worked and kneaded, and whiting added as required. The more it is kneaded the better it will be.

SKYLIGHT PUTTY.—A very satisfactory putty may be made from paint skins, etc., boiled and made into a putty with whiting. Or, to 10 per cent. dry white lead, and 90 per cent. best whiting, add boiled oil until the mass is of the right consistency, then work and knead it, let it lie in a mass on the table for three or four days, to sweat out, then knead it more, and you will have one of the best skylight putties made. As with all good putties, the more it is kneaded the

better. The first of these two formulas is especially good for iron skylights. The second also is good for the purpose, for wood or iron.

GREENHOUSE PUTTY.—This putty must be rather soft or elastic, and may be made by mixing together 9 parts of raw linseed oil, 1 part beef tallow, and enough white lead or whiting or mixture of both, to form a putty. This putty never hardens, and therefore allows for contraction and expansion. A soft putty for hot house sash and skylights: Mix together 10 lbs. best whiting and 1 lb. dry white lead, adding enough boiled oil to form a paste, with also a little cottonseed oil, say one-half gill. Or beef tallow may be used in place of the cottonseed oil. A putty made from dry white lead and ordinary glazing putty, adding as much dry lead as the putty will take, then adding a little glycerine, to make it elastic, is recommended by some. Liquid putty, for use in a glazing machine, for greenhouse work, may be made by adding boiled oil to ordinary putty until of the right consistency for flowing from the machine.

FRENCH PUTTY.—Mix ½ lb. burnt umber in 1 lb. raw linseed oil, then slowly add equal parts of dry white lead and whiting, mixing the mass thoroughly and kneading it well.

VERY HARD PUTTY.—A hard putty to be used as soon as made, is made from dry red lead mixed with boiled oil and copal varnish. It is useful for brick fronts, or any exterior work requiring such a cement. It hardens at once.

FACING PUTTY.—For facing up defective work, and general puttying. Mix equal parts of dry white

lead, dry litharge, and best whiting, adding some boiled oil, and work to form a soft putty.

A Very Durable Putty.—Boil 4 lbs. burnt umber in 7 lbs. raw oil for two hours; stir in 2 oz. beeswax; take from the fire and mix in $5\frac{1}{2}$ lbs. whiting and 11 lbs. dry white lead. The perfect admixture of the mass is essential to good results.

Putty for Floors.—Litharge 1 part, plaster paris 2 parts, glue 1 part, water 8 parts, cement 4 parts, sawdust 2 parts, casein 5 parts, water 30 parts, ammonia 3 parts, dry fresh powdered lime 3 parts. A cheaper and easier way to cement floor cracks, when rather large, is to soak old newspapers in a paste made by boiling one pound of flour in three quarts of water, adding one teaspoonful of alum. The mass should be like common putty in consistency, and may be forced into cracks with putty knife. When dry it can be painted or stained to match the floor, or coloring may be added to the mass. It hardens like papier-mache. For small cracks in floors, paste wood filler may be used. It may be stated here that for wide cracks in floors or elsewhere the putty must be non-shrinkable and very adhesive. Large openings may be fitted with a strip of wood. For large cracks try this: Mix equal parts of litharge, fine white sand, and plaster paris, add boiled oil, and mix to a stiff paste. It adheres well, becomes very hard, and will not shrink.

To Harden Putty.—To make common putty dry harder add a little plaster paris. Red lead is also good, and for a little slower drying add white lead in place of the others. Or use a little turpentine and less oil in the mixing.

HARD PUTTY.—Painters sometimes make the mistake of adding too much lead and varnish to whiting putty to make it hard, the result being that it is hard and brittle, too, breaking up easily. Better add a little coach japan drier, or, better still, a little red lead. A good formula is the following: Add some whiting to dry white lead, and thin with gold size japan, adding a little boiled oil to give elasticity. This makes a good, hard putty for use where ordinary putty is too soft, as on hardwood, iron, etc.

WATERPROOF PUTTY.—What is called waterproof putty, used for glass roofing, is made by melting together 2 parts of rosin and 1 of tallow, adding a little oil. It is used by spreading it out on strips of muslin or cotton cloth, one edge of which is applied to the framework of the iron, and the other is laid over the edge of the glass.

MAKING COLORED PUTTY.—Use dry white lead, not whiting, for colored putty for matching natural finish woods; whiting will not give as pure tints as lead. For pine, tint with raw sienna; for oak, tint with raw sienna or ochre; mix burnt sienna and burnt umber for walnut, and burnt sienna for mahogany. Make the putty a little lighter than the wood, for it will darken some in time.

TO SOFTEN HARD PUTTY.—Heat will soften the hardest putty. But it will harden again after cooling. Break it into lumps and place it in a pan or kettle, with enough water over it to cover; then add a little raw oil, and let it get quite warm, even hot, on the stove. The putty will absorb the oil, and the water may be poured off. Then knead the mass well,

adding enough oil to make it the right stiffness, and keep in a warm place, for it will get stiff again, in a cold place. Or hard putty may be placed in a pan and set on the back part of the stove, where the heat will soften the mass, when it may be worked soft with a little oil, adding some whiting to prevent it sticking to the hands, then knead it with a half-round stick, working out all the lumps and making it like dough. Such putty is really better than a freshly made one, but should be used at once, as it gets hard again, or very stiff.

NON-SHRINKABLE PUTTIES.—A very elastic putty may be made from this formula: 15 lbs. best whiting, 27 oz. rye flour, and two quarts raw linseed oil. Mix and knead well. Another formula is one used by some manufacturers for making what used to be known as Swedish putty. To 6 lbs. best whiting add one quart of water and mix thoroughly. Then mix separately 50 lbs. commercial whiting, $6\frac{1}{4}$ lbs. dry white lead, and one gallon of raw oil. Mix well together, then mix with the first mass, thoroughly incorporating all together. This is said to make an excellent putty for wood, iron or stone.

MAKING PUTTY.—The making of ordinary putty is a very simple operation, consisting in the mixing together of oil and whiting. Yet one must know how if he would make a good putty. In the factory the oil and whiting are placed in a mill called a chaser, heavy iron rolls revolving around and around the bottom of the mill, and crushing and fining the whiting, and thoroughly mixing the ingredients together. Then it is thrown out onto a table to lie a few days, to sweat out, or ripen. Then it is placed

in the chaser again and rolled more. The more putty is worked the better it is. In the shop the whiting and oil must be mixed by hand, first with a paddle, then with the hands, kneading it like dough. It should lie a few days to sweat out, then be kneaded more.

There are several grades of whiting, the commonest being called commercial, which is very coarse and dark and damp. Marble dust is also used. Even the best grade whiting may be inferior at times, owing to imperfect manufacture, for whiting is made from lumps of native chalk, it being boiled, to relieve it of sulphur. Sometimes the whiting will be badly sifted, or levigated, being coarse and full of hard pieces and lumps. When whiting contains free lime it is bad. In any case, whiting must be made perfectly dry before being used in putty making, though this is sometimes omitted by some putty makers, as it requires more oil to mix dry whiting than damp. Indeed, in making cheap putty, water is added. Rosin oil, fish oil, petroleum oil, these are also some of the nice things that are apt to get into so-called cheap putty. It is unnecessary to add that the use of cheap puty is a very poor sort of economy.

Poor putty always has a vile odor. It is also heavier than pure oil putty, for you can put 30 lbs. of cheap putty in a can that will hold only 25 lbs. of pure oil putty. That would indicate a loss to the buyer. You pay for five pounds of waste material that you get no good from. Five pounds of good putty will fill a lot of nail holes. Some cheap putty is made from marble dust and "putty oil," this oil being deodorized mineral oil. The putty never becomes hard, and if you chance to get some of it, mix some dry lead with it.

Putty should have the right proportions of adhesive and cohesive properties, should dry slowly, and in drying should expand and fasten to the walls of the nail hole or to the woodwork of the sash and to the glass; it should not crack, contract, or fall out.

Putty is sometimes put up in 8 or 12 pound bladders, this preventing drying out; and it is also put in tin cans, this being a particularly good method for preserving the putty and keeping it moist. Putty is also sold in bulk, in kegs and barrels. The 25 or 50 lb. tins are to be recommended, for they are handy to get at, the covers keep the putty from drying, and when empty the tins are useful for paint. Keep the lid on. When you have some putty left from a job, throw it into the tin, and replace the lid. This is better than keeping the putty with water on top. If the putty is too soft for use, when taken from the can, mix some whiting with it. Lay the putty out on a board, and sprinkle some whiting over it. This will absorb the excess oil. Some commercial putty has lime in it, marble dust, likely, and this hardens it very rapidly when exposed to the air. In sashes it soon crumbles. Poor putty that has been mixed with mineral oil especially will cause white paint placed on it to turn yellow, and also will make the paint peel off, some of the putty going with it. When such a putty is used to fill nail holes over which dark paint is applied, it will cause the color to fade several shades lighter than the adjoining parts. It causes white paint to turn yellow, and retards the drying of the paint. When these poor putties refuse to dry properly it is a sign that neutral petroleum oil has been used in them—add some litharge or red lead.

In cold weather the problem is to keep the putty from becoming too hard to work easily or properly,

and in this case add a little glycerine; fish oil or cottonseed oil also are good. In warm weather more whiting is required to keep the putty from being too sticky.

SWEDISH PUTTY.—Non-shrinkable, and used for wood, iron and stone work. To 6 lbs. best whiting, add 1 quart of water and mix it to a paste. Then mix with it 50 lbs. whiting, 6 lbs. dry white lead, and a gallon of raw linseed oil.

SKYLIGHT PUTTY.—Best whiting 15 lbs., dry white lead 5 lbs., pulverized silica 1 lb., red lead 1 lb., raw linseed oil about 3 pints.

WOOD PUTTY TO MATCH WOOD.—Mix some sawdust of the wood to be puttied, or if not feasible, use some color with the putty to match the wood, mix to a putty with glue size, adding a little whiting, silica or barytes for the body, or use just glue and sawdust, though this latter is more apt to soften in presence of moisture and fall out.

MASTIC PUTTY.—This is used in a machine for glazing greenhouse sash, and is made by adding 10 per cent. white lead to ordinary putty and using boiled oil as the liquid. It must be made thin enough to run from the machine freely. This putty must have been well sweated out or it will cause trouble on the sash afterwards.

HOME-MADE PUTTY.—A painter uses this method: In a barrel containing 100 lbs. best whiting he pours 18 lbs. of pure linseed oil, and when he needs putty he goes to the barrel and takes out what he wants

and kneads it up for use. This putty will not become perfectly hard under from three to six years, and will never scale or crumble.

WATERPROOF PUTTY.—Useful for aquariums. One-half pint each of litharge, fine dry white sand, and plaster of Paris; one gill of powdered rosin. Mix with boiled oil and add a little paste drier, then beat to a stiff putty, which leave stand about four hours before using. If let stand more than 12 hours, it will lose its strength. This putty will resist fresh and salt water. See that the tank or aquarium is perfectly dry before applying the putty.

PUTTY FOR KITCHEN SINK.—Powdered litharge 20 ounces, and powdered dry slacked lime 1 ounce, made into a putty with raw linseed oil.

QUICK DRYING HARD PUTTY FOR MOTOR CARS.—This class of putty should be tough and tenacious, and possess a stick-to-it quality equal to every strain and sort of service imposed upon it, which service, as we all know, is more severe than any to which the horse-drawn vehicle is exposed.

Drawn putty, or glazing putty, as it is locally known, is made of one part whiting, best quality, one part oil ground lead, and two parts dry white lead. Reduce to a plastering consistency with equal parts of quick rubbing varnish and coach japan, kneading the mass out clean and smooth. This pigment may be put on one day and sandpapered and coated upon the day after.

General purpose putty sufficiently elastic to meet motor car requirements: Three parts oil ground lead, two parts dry white lead, and one part whiting,

kneaded to a working consistency in equal parts of rubbing varnish and gold size japan.

One part whiting and two parts dry white lead mixed to proper consistency in equal parts of quick rubbing varnish and pale drying japan, thoroughly compounded, gives a quick and hard drying putty for car work.

To Keep Putty in Good Condition.—It is not a good plan to pour water on the top of putty in order to keep it soft. Putty will absorb water in spite of its being made from linseed oil. The best plan is to pour on the top of the putty keg some raw linseed oil. This will soften the top of the putty, but if when the putty is being taken from the tub, some of this is removed, it may easily be stiffened by the addition of whiting.

Some painter suggests wrapping putty in a paraffin paper to keep it from forming a skin on the outside. Very good, perhaps, where you have a small lump you don't want to dry out over a few days, say some white lead, or even common whiting putty.

Putty Puckers on Sash.—One has not infrequently seen the paint on the ribs of a greenhouse frame and on window sashes, where painted over, the putty all shrivelled up. Why is this? The reason is not to be found in the paint, but in the putty over which it is laid. Much of the putty sold to-day is made of inferior materials, especially inferior and cheap oil.

The constituents of good putty are whiting and linseed oil. The price of the latter of recent years has been a great temptation to cheap makers to in-

troduce cheap substitutes, consequently this shrivels up on the surface, and does not dry below, hence the puckering, which is so unsightly. For a very good putty dry lead can be added to the whiting and oil —not a great quantity—this will help to solidify and harden it, and make it more durable. Sometimes a sprinkling of fine plaster of Paris is used to harden the putty, but this must not be allowed to stand long, or it will have the same effect on the putty as the red lead. It should be added as the putty is used. Just sufficient for a few hours' work.

MAKING PUTTY.—We placed a pan of whiting on the stove and left it there until the whiting was dry. Then we rolled it on a board until in a fine powder. Then we rolled it into a dough with raw oil, and added a little red lead, too. The old shop foreman would say: "Now, that *is* putty." We figured the cost at $2\frac{1}{2}$ cents per pound. I can show you glazing done with that putty in 1881, and it is as hard as iron.—*Correspondent.*

You can put 30 lbs. of poor, cheap putty into a 25-lb. tin. It is heavier than good putty. It also hardens quicker when exposed to the air.

One pound of dry white lead to each nine pounds of whiting will give a harder drying putty. By adding boiled oil instead of raw oil the putty will dry quicker.

NAIL HOLES THROUGH PUTTY.—The puttying done on priming coat showed through the second coat, of white, turning yellow. The oil in the putty was the cause. Use a putty made chiefly from white lead in oil, to which add whiting and a very little varnish, to toughen it, and knead it well.

PUTTY THAT WILL SANDPAPER WELL.—To make a putty that will sandpaper easily and yet remain where it is placed, take dry white lead and mix it in ordinary brown japan, and add a little lampblack and a few drops of rubbing varnish. If the putty is desired to sandpaper very easily, a little turpentine may be added with advantage. The more varnish added, the tougher the putty will become, and the more difficult it will be to sandpaper it.

COLORS FOR PUTTY.—Ordinary painters' colors in oil, preferably transparent colors, such as burnt and raw sienna, burnt and raw umber and lampblack, are said to be best for coloring putty. Make the putty several shades darker than the wood, as all wood grows darker with age.

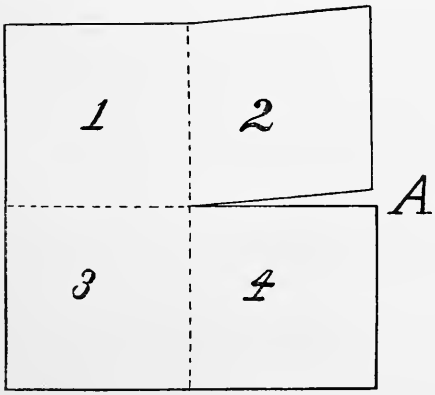
TO REMOVE OLD PUTTY FROM SASH.—If the putty is very hard to remove try softening it with something, either heat or chemical. Here is a method advised by *Engineer and Fireman,* which we have not tried:

Remove the window sash and lay it flat on a table, with the putty side up. Take a common spring-bottom oiler filled with gasoline and squirt a small quantity of gasoline on the putty all around the sash. Apply a match, and the heat of the burning gasoline will soften the old, hard putty so that it can be removed with a putty knife without cutting or defacing the sash. If the putty is very hard, a second application of the gasoline may be necessary.

SANDPAPER AND ITS USES

IN these days of delicate finishes of woods, scratches or cuts by negligent sanding loom up conspicuously. Sandpaper, used on finish, must be kept moist. Old finishers usually split their paper and then moisten the back. This is so that the paper will give way under pressure rather than to press in on the soft part of the wood. An experienced sander will have at hand a sponge with which to moisten his paper as he uses it. To-day you can purchase sandpaper that is coated on both sides, and on which a split is started so that when you come to use it, it is merely necessary to pull it apart. There are various makes of sandpaper, some having preference in one shop and some in another. The main thing is to know what degree of coarseness or fineness to use, and then to see that the men use it properly.

The following method of folding a sheet of sandpaper so that no two sanded surfaces will come to-



gether will often prove a great convenience, and a whole sheet folded in this manner forms a pad for the sandpaper block:

The sheet is first cut half-way through in the middle, as at A in the illustration. The quarter marked 2 is folded on 1 (the illustration showing the plain side of the paper); then this is turned on 3 and finally on 4, forming a pad of four thicknesses, no two sanded surfaces coming in contact.

For inside work I would not use anything coarser than No. 1 or 0, and I would use 00 for finishing. Always sandpaper with the grain of the wood, otherwise you will make scratches that will have to be filled. Some flint paper is nearly as hard as emery. It is better than the common paper in use, but it costs a little more, though it would be more economical to use it.—*Veteran Painter.*

By chalking the back of the sandpaper it will not slip under your hand. Save worn pieces for work that requires a well-worn sandpaper. There's a good deal of waste with sandpaper by most painters.

To make sandpaper cut faster, wet it with benzine, and to make it cut still faster, add a little ammonia to the benzine. Be careful when sandpapering not to cut through edges; bear on with even and gentle pressure, and go over the surface of the work evenly and thoroughly. Apprentices particularly need proper instructions regarding this lowly but highly important part of the art of painting.

To cut sandpaper, fold it square, double over, sanded side inside, to prevent cracking of the paper. Cut apart with an old case knife, which is better to use than your putty knife. Then fold again, for use. An eighth page size is preferable by car and car-

riage painters, and a fourth size page by house painters. Square corners with each cut. Hold the paper firmly when using it, and to prevent its slipping under the hand, chalk it on the smooth side. Never use more than a double-once piece at a time. For small places you may tear off a thin skin of the paper, with the sand on it.

There is a great deal of poor sandpaper on the market. It is easily told. Pay top prices and get the best. Poor paper will crack badly when doubled. If you rub two sanded sides together and the sand comes off easily, it is poor. Good paper is tough and elastic, the sand holds tenaciously and is evenly sifted on, and it cuts clean and fast.

Sandpaper is indispensable to the painter, although he might use steel shavings for many purposes, yet it would not successfully take the place of the sandpaper. A quantity of the various sizes should be kept on hand, from the very coarse, or No. 3 to the very finest, or Nos. 00, 1½, and 2, are the most used, and of these a larger quantity should be kept. Keep in a dry place, for dampness is fatal to sandpaper.

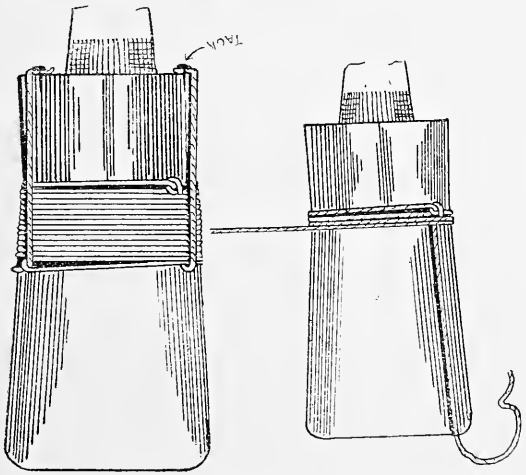
BRIDLING BRUSHES

MANY ingenious devices have been originated for the "bridling" of paint brushes, but with the single exception of the old-time twine bridling none have been perfectly satisfactory. The latter is the only practical way, and will not, in all probability, be superceded by any other method. By this hand-bridling method, every painter may bridle a brush just as he wishes, and to meet any particular peculiarity of the brush. Yet the method is not without its weak points. It requires that a tack be driven into the head of the butt of the brush, where it not only endangers the integrity of the brush, but constitutes a menace to the hand or fingers when handling the tool. Also, the bridling, particularly when on a new brush, or until the twine becomes set with accumulated paint, moves down from its proper position, and gives the brush a bad working shape.

Many patents have been issued for brush bridles, some of which I have some knowledge of. The first I have known were the Sibley bridles, invented by a man of that name, residing in Bennington, Vt., a merchant. His bridle consisted of a woven web of elastic, with a piece of tape at either side, which was to be tacked to the head of the brush, the same as tacking the old-fashioned way. These bridles were made in different sizes to fit the different sizes of brushes, and I liked them very well and used many of them. But they were a failure from a business standpoint, for the same reason that all patented devices for the purpose have failed—painters would have none of it.

Lewis' wire brush bridle was the invention of a practical brush maker, and later salesman.

THE OLD WAY.—Take the twine and hold it against the head of the brush, with the thumb, allowing about six inches to hang loose along the bristles and parallel thereto; now bring the rest of the twine around and around until you have covered the bristles as far as necessary. Some first tie the



first round of twine where the thumb is holding, but many simply pass the twine around and when the six-inch end is brought back it is slipped through the loop formed and drawn tight and tacked. The remaining end of the twine is now brought back around the bristles half way, and there a loop is formed, through which the free end of the twine is run, drawn tight, and tacked to the brush head and cut off.

Some place a piece of stiff, smooth paper around the bristles before bridling, to keep the bristles straight, and after the bridling is done the paper is pulled out.

Common brown twine, of a size suited to the size and character of the brush is mostly used for bridling, but fishing line, or cord such as is used for plumb lines and masons' and carpenters' chalk lines, is better.

Bridling the brush too tight results in "choking" it, twisting the bristles and forming a "swallow tail," and sometimes permanently deforming the brush. Draw the twine firmly, but not too tight. If the brush is placed in water after bridling it, as many do, the water will swell the stock so that the twine will become very tight, and this must be allowed for in the bridling.

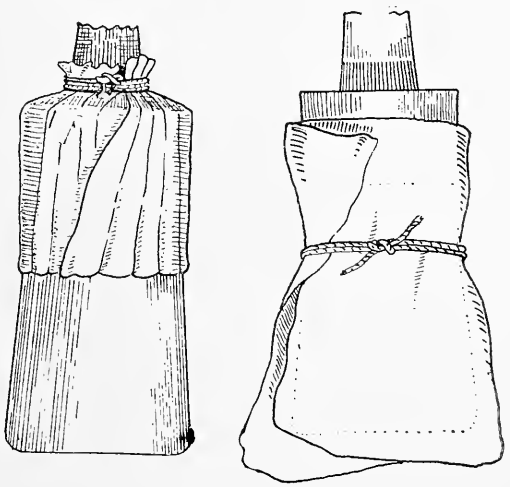
Soaking the newly bridled brush in water a short time prevents the slipping down of the twine, but soaking in water is a bad practice.

The purpose of bridling is to shorten the bristles temporarily, and enable better work to be done with it. As the bristles wear down the bridling may be shortened by removing a portion of the twine from time to time. When the bristles of a brush are too short to bridle, and it is desired to shorten them somewhat, a rubber band serves the purpose well.

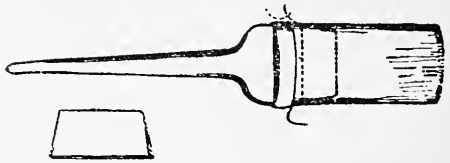
To Bridle a Sash Tool.—The method is very much the same as for a larger brush, the fastening of the two ends being different. These are some-

times tacked with very small tacks, or a slit is made in the handles above the binding and the ends of the twine are forced into the slits with a putty knife, holding them perfectly.

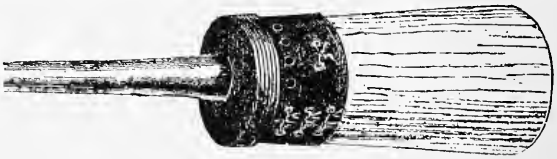
Rag Bridling.—The illustration shows this way very clearly. Tie the rag on as shown in the first figure, then pull it back and fasten it to the handle by tying.



Breaking in a New Brush.—Here is an old idea that will be new to many. It comes from Australia. Make a wooden wedge of sufficient length and width, say 2½ inches long by 1⅝ inches deep, and ¼ inch thick. But this according to size of brush. Cut two notches near the top of the wedge to hold the bridling. Place the wedge in the middle of the bristles, which will keep the bristles in place and prevent crossing or twisting of same.



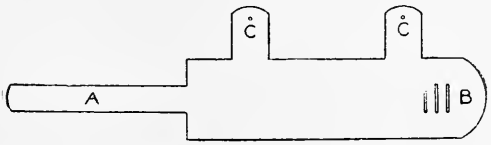
The annexed illustration shows a patent bridle of perforated zinc, twine and leather. It consists of two leather flaps, held at one end between the plug and the brush ferrule, the edges of the flaps having eyeletted holes to be connected in pairs by cords. When the brush has worn down sufficiently the outer



ends of the flaps with the outer cords may be removed by cutting, and so on as the wearing continues. Near the center of the flaps are holes to receive a cord extending transversely through the bristles and back again, portions of the cord lying at each side of the center, and its ends being tied at one side, as shown in illustration. Near the base of the flaps are holes for permitting paint to ooze through when working the brush back and forth to clean it, but when the brush is to be thoroughly cleaned, the flaps are turned back.

Cleaning Under Bridling.—Paint will become hard under the bridling, and the twine should be removed frequently, and the brush cleaned out thoroughly, particularly about the butt bristles, for this will give the brush all its original spring or elas-

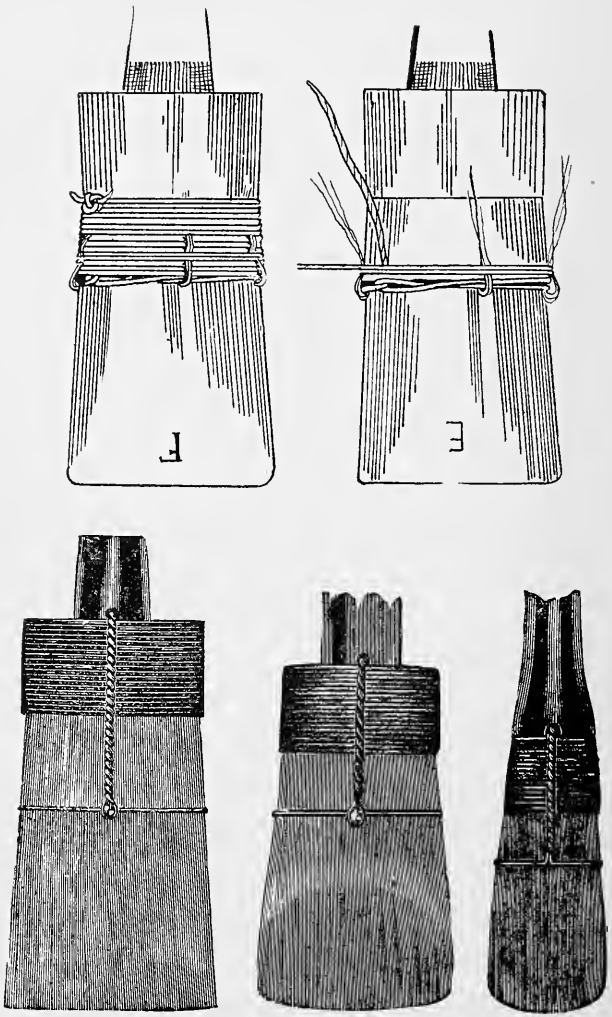
ticity, and the brush will do better work and last longer. Yet it is very rarely that such cleaning is done.



Here is an idea of making a bridle of thin metal, such as tin or brass, with the edges filed off slightly to prevent them from cutting the bristles. The shape of the piece of metal for the bridle is shown in the sketch. The size can only be determined by the size of the brush on which it is to be used.

The metal is placed around the part of the bristles next to the stock, and is fastened by inserting the tongue A into and through the slits at the end B. The projections C C are tacked to the top of the stock in the place where twine bridling is usually fastened.

An Unusual Way of Bridling.—This device is taken from an English exchange. Start to wind the twine at the place you want the bridle to stop, as shown at E. Then, here and there, pull down a few bristles over the twine, which is to prevent the slipping of the bridling. Bring the bristles over and under the twine to hold them fast. Finish by tying the two ends of the twine together, as shown in F.



Lewis' Patent Wire Bridle

Marking the Jour.'s Brush

Where several men are employed it is necessary to mark the brushes so that each man gets his own and not another's. Where no system is in force, where there is a tank for holding all the brushes, none of which are marked, a man picks up a brush and examines it, and if it does not suit, will select one that does, always taking the best, of course, and by this method there is waste and loss to the master painter not inconsiderable. In shops that have the private locker system, whereby each man has a place to keep his tools and overalls, etc., with a private key, a kit of brushes is given him, and the brushes are marked with a number. The tools given to the man are charged to him, and he is held personally responsible for them, and if any are lost or damaged he must make good, an easy matter when we consider that the boss has his wages in hand. Being marked, he can always identify his tools. Now, what is the best way to mark the brushes? We are all familiar with the initials cut into the handle, which greatly disfigures the brush, and when handed to another man for his use, the initials are not his. A better way is to have small, brass plates with the number stamped on, with little brass pins for fastening it to the brush. Some have used thin brass with a number stamped thereon, and this soldered to the metal ferrule, but this involves too much trouble, in soldering, etc. Another method is that suggested by a master painter, as follows: Bore a small hole in the handle of the brush, close down to the butts of the bristles, and let this hole stand for 1. Then, for a 2, bore another hole, one-fourth of an inch above the first hole, and so on, with holes a quarter inch apart,

it being possible by this method to register up to 29 on an average 6-0 brush, the handle being about $7\frac{1}{2}$ inches long. The average wall brush is $5\frac{3}{4}$ inches long, and can be numbered up to 23. The handles of sash tools, dusters, etc., may be thus numbered. I am not aware that this plan has ever been tried. Other methods may occur to the reader, but in any event, it will pay to mark the brushes so that each man can be held accountable for its use or abuse.

It would also be well to stamp all tools with the name of the employer. Dishonest men can and do steal the employers' brushes and other tools, and hence it may be some sort of a safeguard to stamp them with your name and address. This can be done with a hot branding iron, or metal tag. A painter's house, when searched, was found to contain a bushel of good brushes, stolen from various employers. But there was no way for any employer to identify the goods as his. With a mark on the brush, whether a jour.'s number or address of the owner, it would have been an easy matter to identify any tool.

Notes on Cleaning Brushes

—Soak the dirty brush in ammonia water.

—Do not cut away the hard outside bristles.

—Creosote oil is a good brush cleaner.

—Benzine is not as good as coal oil for cleaning a brush.

—Benzine and naphtha gum up oil paint, hence are not good.

—Coal oil does very well in cleaning, and it evaporates.

—Soak in turpentine and renew fluid now and then.

—Hot turpentine is a ready solvent, but beware of fire.

—Hot oil is useful, but do not let the oil get on the ferrule.

—Soak 24 hours in raw oil, then rinse in hot turps, repeating process until clean.

—Lye water softens and burns bristles; even a very weak lye will do it.

—Paint and varnish remover takes the life out of bristles, leaving them flabby and without spring.

—Make a thin paste with washing powder and leave brush in over night.

—It may require 48 hours to do the work with soap powder, and afterwards wash out with clear water.

—If hard all through soak in dilute ammonia, then rinse with turpentine and wash with soap and water.

—Make a stout lather with common soap and work well into bristles; lay brush away for some time, then wash out the soap, and it is ready for work again.

—Soak in turpentine, then wash out in soap-suds water; then rinse in clear water, and roll the brush rapidly between the hands, to dry it out.

—Some claim to clean out hard old brushes with hot coal oil, then rinsing with ammonia water.

—Before placing in hot turps, wrap the brush in paper to preserve its shape.

—Hang the brush in hot water, below ferrule, and when outer bristles are soft, pull them apart with pliers, and repeat hot water bath until the center can be reached. Then set brush in turpentine; after a few hours, lay the brush on a board and work out old paint with putty knife. If not soft enough, boil in soapy water, strong suds.

Notes on Care of Brushes

—Fill the brush with soap lather and lay away for winter; it will be in good shape for spring work.

—Clean the paint brush when done for the day.

—Paint brushes keep well in oil; the oil may be used afterwards for some other purpose.

—Water is only a desirable medium for paint brushes for over night.

—Have a board near the brush-keeper, and when full of paint remove and put up a clean one.

—A bristle is solid one-third of butt part, the other part being a hollow tube, taking up water, and so becoming flabby.

—If kept in water, the paint brush should not be left too long without working in paint.

—Some prefer filling the brush full of paint and laying it on a board over night, not in water or oil bath.

—For winter keeping, suspend in raw oil, hole in brush and wire through it.

—Kept in water, suspend by wire run through handle.

—Never allow the points of bristles to rest on bottom.

—Too long in water injures spring of bristles.

—Shellac the twine binding of the brush and water will not rot it

—Turpentine makes bristles harsh and divides the same so that they will not lie together; hence, turps is not a good medium.

—Some painters mix turps and raw oil to keep paint brush in.

—Foul water rots bristles; change the water, keep it pure.

—The brush keeper, especially for varnish brushes, should have a cover, to keep out dust.

—The brush should never be immersed above the bridling, at its lower end.

Change the water daily in summer, and at least once a week in winter.

—Add a little salt or glycerine to the water in winter, if there is danger of freezing. Glycerine is best.

—Glue-set bristles must not, of course, be kept in water.

—The very best way to keep paint and varnish brushes when not in use is to clean them out and put away; even oil is detrimental to bristles, injuring spring.

—Take a candy bucket, paint inside well, and place a row of small hooks around inside, near top, to hang the brushes on; water enough to cover bristles only.

—Cement-set brushes should not be placed in an alcohol mixture, such as shellac, etc.

Some Practical Brush Notes

—Never use a brush for other than its original purpose.

—Never keep brushes in either a very warm or damp place.

—The brush will suffer more from neglect and careless using than from any other cause.

—A high-grade chiselled bristle paint brush is best for good interior work.

—If the bristles of a new brush are not straight, place a moment in hot water, then straighten them out on a board.

—Better work can be done with a round or oval brush than with a flat wall brush.

—On large areas more work can be done with a wide wall brush than with a round or oval brush.

—If a brush has suffered from too much heat restore it by placing in the cellar for a while.

—Better not soak the new paint brush in water, but place in oil or paint at once.

—A little raw oil placed in the butt of the brush is a very good thing, better than soaking.

—As the duster costs less than a good paint brush, it is unwise to use the latter in place of a duster, even for a very little time.

—New brushes should not be kept in a dry or warm place, particularly near a stove or other source of heat, as they are liable to be injured.

—If a partly worn small brush is cleaned, it will make a very good shellac brush, as alcohol softens the bristles of a new brush, making them more or less flabby.

—The best new brush will shed a few bristles, but if very many are shed there is something wrong.

—Be careful in breaking in a new brush, for on this will depend the future poise, hang, point and balance of the brush.

—If the new brush sheds some bristles, strike it gently against the edge of a board or your hand, or run against a rough board, to bring out all the loose bristles.

—The stippler should be washed out in warm water if in water color, at the close of the day; it should not be left in water over night. Same with oil color brush.

—A painter says he places a new brush in raw oil and lets it soak as long as he can before using it.

—Improperly cured bristles are apt to curl badly, but improper wiping off of the brush before putting it away for the night is the most frequent cause.

—Never wipe the paint brush on the edge of the pot so that the outer bristles will catch on the edge, for that will make them curl or straggle and stand out from the rest.

—If the ends of bristles curl up while painting blinds, frill or fret work, dip the ends in hot water and they will straighten out.

—Wear a paint brush to a chisel point, and not to a round point; avoid wearing it to a long, slanting chisel.

—Some painters will wear out a brush in much less time than others will, it depending on the way it is used.

—It is desirable to keep certain brushes for dark paint, others for light color, not changing back and forth, which injures the bristles by the cleansing process involved.

—If the bristles of a new brush come loose, put in a damp place for a while, or pour a little warm water in the middle of the butt bristles, which will swell the bristles and the binding.

—Another good way to remedy a brush with loose bristles is to drive a small wooden wedge between the handle and the bristles, so as to tighten them.

As turps tend to stiffen bristles, if a brush is rather soft or flabby, place it in turpentine, or if new use it in turpentine staining, for a while, after which it may be used in paint, the bristles much stiffer.

—The brush made soggy by the water bath may be soaked in turps, papered up, and left to dry. If originally a good brush, this will restore it to its original elasticity.

—Too much driers in paint gums up the brush. Clean off at night, work out in some coal oil, before putting away.

—If the ferrules are covered with hard paint, scrape off after soaking with paint remover or lye, a wire scrub being good, and benzol or alcohol makes a good softener.

What Brush Makers Tell Us

—Many painters say that whalebone is used in some paint brushes; not so, never so used.

—The process of bleaching bristles injures them, hence the white bristle brush is not as good as you think.

—Black Russia hog bristles are better than black Chinese hog bristles, hold more paint, and wear better.

—The black and natural white or yellow Russia bristles are equally good.

—Bleaching is done simply to make the brush look better.

—Bleaching with sulphur fumes injures the bristles.

—Bristles held by a metal ferrule and held entirely by mechanical pressure, will not be affected by any liquid nor be subject to shrinkage.

—The brush stamped "cement set" is intended for use in paint, varnish, paste and water colors, and should never be used in shellac or other alcoholic solution.

—The brush stamped "glue set" is for use in shellac and varnish only, nor should it ever be put in water.

—Good paint brushes will be found with several lengths of hair in the middle; if the short bristles

were put on the outer side, the brush could never be broken in with a good cutting edge, but it would wear to a pencil point.

—Take a hog bristle between thumb and finger and work it to and fro, holding it parallel with the finger, and it will travel in one direction only. Try it.

—Chiselled paint and varnish brushes are not ground, but have the bristles arranged to form the chisel shape, by the mould; taking an ordinary brush and grinding it down would result in some very stiff bristles and a very poor brush.

—A good Russian or Siberian bristle brush will do finer work, wear longer, carry a heavier load of paint, and distribute it more evenly than a Chinese bristle of the same size, style, weight and length.

—The flat duster for painters was introduced about 1886, and many prefer it to the old duster, but the latter, too, has its advantages. The flat duster gets into the corners.

—To bleach bristles, wash in soft water and soap suds, then rinse in clear water. Make a solution of sulphurous acid and water and place the bristles in it, and after two days remove and wipe dry.

—A solid bristle brush lacks spring, and the paint gets into the center and makes matters worse. The hollow center brush is the result of years of experimenting, and is the best.

—The nearest imitation of hog bristles is horse hair, which lacks elasticity. Tampico looks like hog bristles, and that is all. There is no substitute as good as the original.

—To test bristles: the odor from a true hog bristle when burned will be that of burned ham, or pork, and it will leave no ash, and will fizzle in burning. A hog bristle tapers to a point, and is split at the

point, making what we call the flag; taken between thumb and finger and worked to and fro, the bristle held parallel with the finger, it will, of its own accord, travel in one direction only.

Fiber burns like wood, with no unpleasant smell, and it will leave an ash.

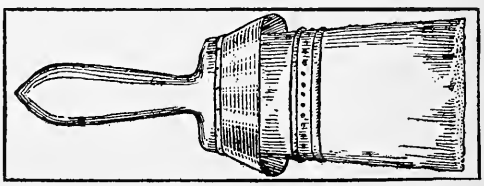
—Round and wedge-shaped brushes are shaped by moulds. Then the bristles are ground to a fine point on pumice stone.

—The pound brush got its name from the fact that the handle used to be driven through by pounding it. Weight has nothing to do with it.

—For large surfaces the flat wall brush is best because it fits the hand better and more paint can be spread.

—Horsehair is of the same thickness throughout its length, while hog bristle tapers to a fine point, and has a horny appearance. With a small microscope you may discover any defects and distinguish imitations from the real. Bristles may be dry, etc., showing inferior value.

—You may tell Russian or Siberian bristles from Chinese by the different sheen, also by its flag, and by the greater amount of barb, or roughness that is like that on a wheat beard. There is very little of this barb on Chinese bristle.



Prevents Paint Running Down On Handle

SCAFFOLD WORK

How to Handle Scaffold Ropes

THE elementary forms of a knot consist of the *bight,* the *loop* or *turn,* and the *round turn.* The illustrations show these forms too well to need further description.

The *figure eight* knot is used for making a knob on the end of a rope for keeping the strands from untwisting, and is easily untied. Form a bight near the end of the rope, give the short end one com-

FIG. 1. BIGHT

FIG. 2. LOOP OR TURN

FIG 3. ROUND TURN

FIG. 4 FIG. 5. FIGURE EIGHT KNOT.

FIG. 6. FIG 7. STEVEDORES KNOT

FIG. 8. A TIMBER HITCH AND A HALF HITCH COMBINED

FIG. 9 HALF HITCH

FIG. 10 TIMBER HITCH

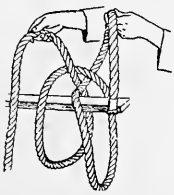


FIG. 11

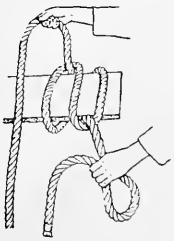


FIG. 12 SCAFFOLD HITCH.

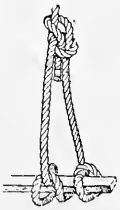


FIG. 13.

plete turn about the long rope, and pass it up into the bight, Fig. 4. Pull short stick or shackle as in Fig. 5, and the knot may easily be untied.

The *stevedore's knot* is made the same as a *figure eight knot,* except that it has two turns instead of one, and may be made either with or without a shackle, as shown in Figs. 6 and 7. It is used for making an extra large knob on the end of a rope.

There are several kinds of *hitches,* some of which we are apt to use incorrectly. Sometimes a *half-hitch* is merely a loop around the rope with the free end pinched between the rope and the post or whatever it may be hitched to.

A *timber hitch* is made by passing the rope around a stick of timber, taking a half-hitch around the rope and then passing the free end once more between the rope and the timber.

A *timber-hitch* and a *half-hitch* combined is useful for long articles, say a plank or scaffold, which must be kept in line with the pull of the rope and the plank. The half-hitch should be around the plank and around the rope. By means of this hitch a plank scaffold may be kept firm, with no danger of turning.

Figs. 11, 12, and 13 show another knot useful for hanging planks or scaffolding securely. Draw to the left the rope in the left hand, Fig. 11, and to the right the rope in the right hand, same figure, gaining the position shown in Fig. 12. Turn the plank over, draw the ropes up above it, join the short end to the long rope by an overhand bowline, pull the bowline tight, at the same time adjusting the length of the two ropes so that they hold the plank level, and the hitch is finished as shown in Fig. 13. Attach a second rope to the other end of the plank in the same way, and the scaffold is ready and safe.

The Care and Use of Ropes

Buy the best, which may be indicated by the price. A rope should be of a bright, clean, new appearance, otherwise it may be made of poor and inferior stock. Dampness is hard on rope. Keep the scaffold ropes in a dry place, neatly coiled and hung up.

It is a common practice to coil four strands of falls at one time; a better way is to pull the two blocks together and lay the rope around them in a neat coil, then securely tie in the usual way.

When coil is to be opened it should be turned upside down and hoisting rope attached to the hook on the upper block, and a light line fastened to hook on lower block, in order to pull same down again. It will be seen that this is an easier way. First, it is a much lighter lift to get tackle to roof, a fact that is greatly appreciated when it comes to a lift of six or eight stories; secondly, it helps to avoid many twists that occur in the other method; and thirdly, it allows you to adjust the falls more readily to the height of the job at hand.

When in use for hauling up the scaffold the rope is bending and straightening as it goes around the pulleys, causing the strands to chafe at the center of the rope. The smaller the pulley the worse this becomes. For this reason the ropes should be run over a pulley of a diameter not less than eight times the diameter of the rope. Rope for transmitting power should have pulleys forty times the diameter of the rope.

Knots make a rope weak because the rope is bent in order to form the knot, and the outside takes the strain at the bend. These are overworked and break.

The strain now rests on fibres below, which in turn weaken and break.

It makes considerable difference even in the way a rope is coiled. Because of the way it is twisted in the making, it should be coiled as with the hands of a clock. In uncoiling, the end last laid down should never be pulled up from the top. If for any reason this must be done, turn the whole thing over and draw the end up through the center.

A good preservative against dampness is copper sulphate, or bluestone, making a strong solution of this and immersing the ropes in it for about three or four days. The ropes should be dry when put into the bath. After taking them out of the bath, hang up where they will dry out soon and do not put them away until perfectly dry.

More About Tying Knots.—The advantages of a good knot are: its ease of tying and untying, its freedom from slipping, and its requiring very little rope to make. It also increases the confidence of its user. The knots here shown are loosely made in order to show clearly their true formation. A good test of proficiency in making knots consists in doing the work in the dark.

All knots will jam more or less when under a strain. A true knot will hold, not let go.

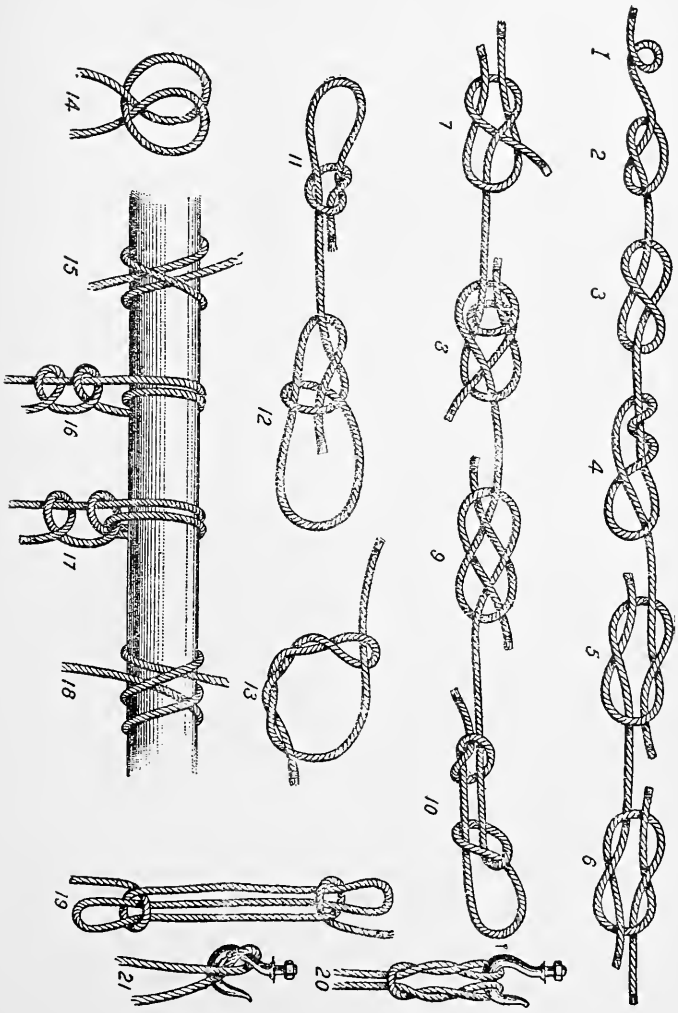
The names usually given to knots, and their uses, are as follows:

1. Bight of a rope.

2. Overhand or thumb knot—To prevent a rope from running out through the sheave of a block.

3. Figure 8 knot—Used same as No. 2.

4. Stevedore knot—Useful when the rope passes through an eye. It is easily untied after being strained.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5. Square or reef knot—Useful in joining two ropes of the same size. However tight it may jam, it is easily untied.

6. Granny or thief knot—This knot is not a safe one, and is the one most commonly tied by people. It is frequently tied in mistake for a square knot. It is likely to slip under a strain, and it is hard to untie when set. Some say it does not slip, though it will jam tight. In any case it is not a desirable form of knot.

7. Single sheet bend or weavers' knot—Used principally for joining two ropes of unequal sizes more securely than a reef knot.

8. Double sheet bend—A more secure knot than No. 7.

9. Carrick bend—Used in fastening the four guys to a derrick.

10. Flemish loop.

11. Slip knot.

12. Bow line—For making a knot that will not slip; as safe a knot as it is possible to make. Useful when a loop that will not tighten is wanted on the end of a rope. After being strained, it is easily untied. Commence by making a bight in the rope, then put the end through the bight, and under the standing part; pass the end again through the bight and pull tight. This knot should be tied with facility by every one who handles ropes.

13.—Timber hitch—The greater the strain, the tighter it will hold.

14. Clove hitch—Consisting of two half hitches, and used chiefly to tie ledgers to standards. On account of its simplicity and security, this is the most useful of all the knots.

15. Shows the close hitch around a pole.

16. Round turn and two half-hitches, for securing a rope to a ledger or for fastening the guys of derricks, shear legs, etc.

17. Fisherman's bend—Used when a thick rope, such as a fall, is made fast to a ring.

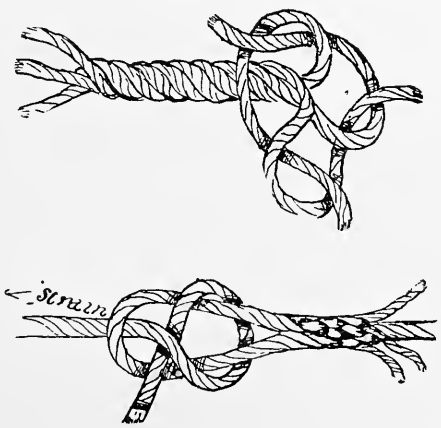
18. Rolling hitch—Used in a variety of ways, but chiefly in making fast one rope to another that is held taut.

19. Sheepshank—For shortening a rope when the ends are inaccessible.

20.—Catspaw—An endless loop, used where great power is required.

21. Blackwaller — Easily applied, but requires watching, as it is liable to slip.

The ends of ropes are often left to unravel, and often several feet are cut away on this account, when by simply binding the frayed ends with twine, or by making a *wall crown,* as shown in the illustration, the rope might be saved.



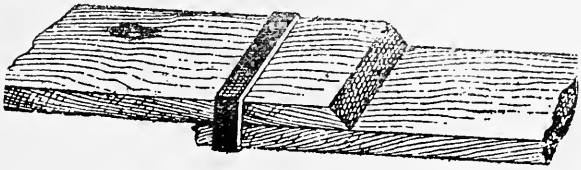
An eye or loop spliced in the end of a rope is often found useful. With such a rope a simple knot may be tied as shown in the illustration; it is called a sheet or becket bend. It may be made double by bringing the end around the eye and out through the same place.

PAINTING A STACK.—A Kansas painter tells how he painted a smokestack 53 feet high and 26 inches in diameter. He says that he got to the top by tying several long, slender poles together, with which he pushed a hook to the top of the stack, letting it fall over and catch the edge. To this hook was attached a rope and tackle.

A man has a steel stack at his factory 200 feet high. It needs painting. There is no ladder at the top, and no apparent means of getting there except by balloon. This was the problem presented to a western mill owner, and he solved it in the following ingenious way: A rude parachute, slightly smaller than the internal diameter of the stack, was constructed; to this a pail filled with light fishing line was attached, and then the parachute was shoved up the stack until it passed the draft opening from the boilers. The hot gases caught it and rushed the whole contrivance up and out of the top of the stack in a jiffy, the fishing line in the meantime paying out as the pail rose, so that one end remained at the bottom of the chimney and the other fell to the ground outside with the pail. By means of this line a heavier rope with a hook catch over the rim of the top was sent up, and with this the painter was able to complete the job.—*American Miller.*

SPLICING PLANKS.—The annexed illustration shows how to splice two planks so that a stronger

scaffold may be had, one that will be strong enough to bear the weight required of it. The strap iron is fastened to the bottom plank, or may be left un-



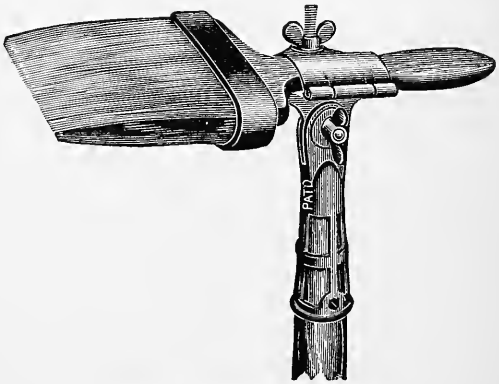
fastened. The same principal is now embodied in the patented extension scaffold plank.

Raising a Ladder.—When you raise a ladder, do not raise it with one leg alone resting on the ground, but see that both legs are resting there. This will prevent strain on the ladder, which in turn causes the rounds to become loose. Also, in taking the ladder down, be careful and do not take it down on a strain, remembering that there is a right and a wrong way for doing even so simple a thing as this.

It seems very simple to see two men put a ladder up against a wall, but it needs care and a knowledge of a few little essential things, or a man may be maimed for life, or the ladder broken. The "footing" of the ladder is most important. It is better for two to be at the foot and one to raise it if there are only three men, and if two are raising they should be of equal height, or nearly so. The one that is raising should push up from the sides, and not from the rungs, and do it steadily, and not in jerks. When there are two raising it, each should take a side and push steadily and together. The one "footing" it should place both feet upon the bottom rung (not on the ground, as it invariably slips), and catching the rung above, throw his weight back so as to pull the

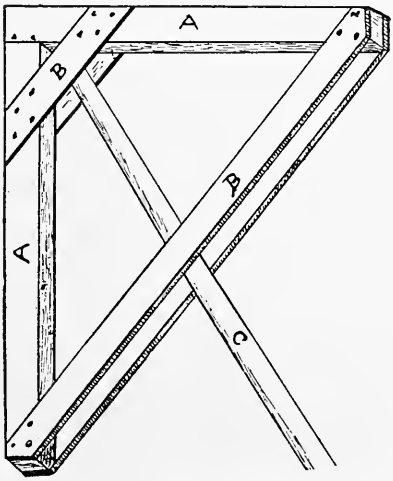
ladder up. He must never get off the rung until the ladder is perfectly upright and then must act in concert with the one who is raising. When two are "footing" one should put the left and the other the right foot on the bottom rung. When lowering the ladder the footer must not get off until the ladder is right on the ground.

Ladder Contrivances.—A handy means of holding the top of your ladder a foot or more from building—convenient for lettering or painting wide cornice—is given as follows: Bore half-inch hole through side pieces of ladder ten inches from top. Take half-inch rod, two feet or more in length, bend at right angles two inches from end—this to fit in the half-inch hole. From the short bend, twelve inches up, bend again—obtuse angle—make two of these, one for each side—place under top round and in the holes, shape them just right and fix to stay in position. The rods can be placed or removed in a moment.



Nelson's Extension Brush Holder

HANDY SCAFFOLD BRACKET.—The device here shown is a drawing that I made from a bracket that I saw in use by some plasterers repairing the gable end walls of a country house. The gable was very high, yet a pair of brackets like this, and two poles, with planks across the brackets, formed a safe and efficient scaffold for two men to work from. As far as strength goes, such a scaffold would hold all the men that could get on it, providing the brackets were close enough together. For the more weight that is



placed on these brackets the tighter the scaffold will hold, for the thrust downwards forces the pole more firmly into the earth. The letter A on the illustration shows a piece of 3x4, while letter B shows common one-inch board. Letter C shows the pole, which may be of such length as may be required for the height the scaffold is to reach. Placing the light end of a pole in the crotch of the bracket it is pushed

upwards, against the wall, until the desired height is reached. The brackets may quickly be made, and then it is only a matter of cutting two tall and slender poles. This, of course, cannot be done everywhere, but if poles cannot be had, then scantling may do.

Scaffold Ropes.—The selection of rope is an important thing, about which a few hints may be useful.

A good hemp rope is hard, yet pliant, of a yellowish or greenish-grey color, and has a kind of sheen, silvery or pearly.

A dark or blackish color shows that in the process of curing, the hemp has suffered from fermentation.

Brown spots point to the fact that the fibres were wet when the rope was spun, and it is therefore weak and soft.

Ropes are sometimes made with inferior hemp covered with good hemp on the outside; this may be found by cutting a piece of the rope and examining it.

Other ropes are made with short fibres, or of unequal length, or are unevenly spun.

The first case is disclosed by the woolly appearance of the rope, the ends of the fibre projecting, thus producing the effect. A close inspection of this kind of rope will disclose other faults. A faulty rope is a dangerous thing.

The knots of a scaffold should be frequently examined as they settle down, and are liable to give way.

It is well to reverse the ropes used with the scaffolding, taking it out and changing it end for end. In this way, parts that have the least wear will be required to take the place of the parts that have had most wear. The custom is to allow the ropes to remain in one position until worn out.

Legless step ladders for outside work are fine. On a step ladder of this kind work can be done with more ease and faster. It is easier standing on the flat step than on a ladder rung, and your pot is before you. Have at least three, 6, 8, and 10 feet long. With these you can reach up to 14 feet.

A Pennsylvania painter tells how he painted a steeple. He went to the base of the steeple on the inside, and cut a hole large enough for him to crawl through. When outside he nailed on cleats one above the other, ladder fashion, and began painting at the top, removing the cleats as he came down. He did the four sides in this manner. This method would not, of course, do on a slate or metal covered steeple.

Step Ladders.—Keep the step ladders in good condition. Repair any defect as soon as in from a job. Look them up and inspect them. Screw up tight and tighten ropes, or replace weak ones. This will save money for you, as the same work done on the job will take much longer time, and cost more, as a man has not the appliances for repairs on the job, and if the steps are weak or wobbly the workman cannot do as much work from them, being afraid of falls.

How to Carry a Pair of Steps.—Teach the boy how to carry a pair of step ladders. It might be well for the men to know how, also. Many do not know how. In going out of a doorway always pass the steps through first, for it is usually the top that does any damage by coming in contact with the door jamb. Keep your eye on the top of the step ladder, clear it first, and the bottom may be depended upon to look out for itself. The same with trestles and any scaffolding material.

Doing Steeple Work.—By the following method a man may climb a pole a mile high. Take an ordinary bos'n's chair with a tail (rope) of sufficient length. Pass this tail around the pole twice, underneath its own part, and once around above, tucking the end under its own part, making a rolling hitch. Get in the chair, take in all the slack rope you can get, raise yourself as high as possible, jamming your hitch tight. Have now a piece of rope of sufficient length, both ends spliced together, pass it around the pole, one turn under and one turn over its own part, tucking the end under, thus making a clove hitch. This is put on about the height of your knees, leaving the loops of your rope hanging down. We will call this rope a *strap*. Place a foot in each loop and raise yourself up; pushing the hitch on your bos'n's chair up as high as you can reach, jam it tight. Sit firm in your chair and draw your feet up, strap and all, as high as you can; then raise up again, pushing the chair up as before, and so proceed until you get to the top.

We sometimes see weather-vanes on the top of a rod anywhere from 6 to 16 feet in length above the church spire. It is necessary to take the vane down in order to re-gild it. An expert says he has taken off and replaced vanes by the above method, some nine feet long and weighing 50 pounds. He has painted many flagstaffs also by this method. The bos'n's chair should fit snug to the hips, and thus situated your hands are free for the work and you are at ease. The sight of a painter climbing a tall pole, and when near the top, sliding all the way down again is a very sad spectacle, indeed. He should use the plan we have given in this account.

PAINTING SMOKESTACKS.—In the *American Machinist,* R. P. King gives an interesting account of how he painted five smokestacks, ranging from 35 to 58 feet in height, at a cost of only $16.60; $10.00 for paint, and $6.60 for labor. His method of getting a line on the top of the stack is worth reading:

"First, I visited the blacksmith and had him make five hooks of $\frac{3}{8}$-inch round iron. The end of the hook is very deep—about five inches—to prevent any possibility of its jumping off the chimney. The eye was about $1\frac{1}{4}$ inches in diameter to allow plenty of play for the passage of the rope.

"Next, I told the millwright I wanted him to help me, and we made the pole. The pole was constructed on what one might call a scientific principle, and was, perhaps, the most noteworthy part of the job. As the highest chimney was a trifle less than 60 feet high, the pole was very conveniently made of 16-foot strips. The upper section was a strip $\frac{7}{8}$ by about two inches; the second section was a strip $\frac{7}{8}$ by two inches, with a $\frac{7}{8}$ by -$\frac{1}{2}$ strip nailed to it to form an angle shape; section three was a $\frac{7}{8}$ by 3-inch strip, with a $\frac{7}{8}$ by $1\frac{1}{2}$ inch strip nailed on to form a T; section four was in the form of a cross, made by nailing two $\frac{7}{8}$ by $1\frac{1}{2}$ inch strips to a $\frac{7}{8}$ by 3-inch. The laps were about two feet, making a pole some 58 feet long. This pole was very light and stiff, and was successful in every way.

"A pole as long as 100 feet could be constructed in the same way, which would be strong enough for the purpose, and at the same time easily handled. If the sections were screwed together, the pole could be stored in a small place, and used from year to year.

"Four small holes were next bored in the top of the pole and the hook was lashed to it with twine in

such a fashion that, while it would stay in place, the lashings were not so strong but that they could easily be broken. A hank of sash cord was procured and run through the eye of the hook.

"One end of a long rope was unlaid and the strands cut, to make a good taper about two feet long, and an end of the sash cord was spliced into the taper. This was in turn wound with twine to make a smooth connection between the rope and the sash cord. The taper was then well covered with soap to make it slide easily through the eye of the hook.

"It would seem that the next problem was to get the hook up over the top of the chimney, but this was very easy. We placed the top end of the pole on one of the guys, and by a proper manipulation of the bottom end, had it in an upright position in no time. The hook was then hooked over the top of the stack, and one man took hold of the ends of the sash cord to prevent the reaction jumping the hook off when the twine was broken. Another man pulled strongly down on the pole, breaking the lashing and leaving the hook at the top of the stack. A set of light blocks was lashed to the free end of the rope, and by means of a long pull and a few gentle shakes, the rope was pulled through the hook, taking the blocks to the top of the stack. The end of the rope was fastened to a post, a board seat was hooked on to the power end of the fall, and we were ready to paint. A whitewash brush on a long handle was used, after removing the rust and scale with a wire brush."

FITTING OUT A PAINT SHOP

WHEN a painter comes to the conclusion to start into business for himself, it is well for him to visit the shops of established painters, and see how things are managed there. Doubtless he will find many shops unworthy of imitation, but he cannot fail to obtain good ideas even from such, for they will tell him what to avoid, while there will be some shops having one or more good features that he will do well to make a note of. Having had some useful experience myself, as a beginner in business, I feel competent to offer some useful suggestions to others.

I will frankly say that I had too high an ideal of what a paint shop should be, for what I got was too costly for my means, it absorbed too much of my little capital. For instance, I could have done without oil and turpentine tanks, pumps, and many other things which were unnecessary, though very useful. I bought a lot of staging things that I really did not need. For instance, I had built a fine big staging, and fitted it with falls, etc., at great expense, only to find that we could not use it on the kind of work we had. What I bought was the best. I remember a jour. saying to me, "Boss, we ain't used to such good brushes as these." They were really too costly, for a cheaper line would have done just as well. So I would advise the beginner to go slow, to have what he cannot do without, and do without what he really does not need. I have before me a diagram showing a modern paint shop. It is about what some painter doing a business of anywhere

from $100,000 to $500,000 a year might have. It is not worth thinking any more about, for the ninety-and-nine painters do a smaller business than that.

Certainly I do advise having a convenient shop, one well lighted and well ventilated. Have a place for every single thing, and every thing in its place when not in use. Keep things clean and in order. Have plenty of light and plenty of fresh air. Dry colors and whiting may be kept in the original barrels, with covers over them. Have a sink if at all possible, for you can hardly do without running water in the paint shop. Paint the names of colors, etc., on the barrels or boxes containing them, and have a drawer for sponges, rags, etc., which may be under the workbench. Oil may be kept in the original barrel, on its side, and a spigot in it. Turps may be kept in a large tin can. So with varnish, driers, etc. I would not have the pots and cans on the floor, but have shelves running around the room for holding them. A number of jars or cans may be used for holding the various little things of the shop, like pumice, glue, plaster of Paris, dry colors for calcimine, etc.

A shop must in many cases serve as a storage room also, for the ladders and scaffolding, and for the stock, such as white lead, etc. Again, it as often serves as the office. When this condition occurs, a large room is necessary. Yet, how often all this is cramped into a cellar. In contrast to such a shop is the one described by a prominent New Jersey painter, as follows:

"Many shops which can now be truthfully called modern were no better than their neighbors in the beginning, but have had proprietors who were alert and observing, and did not fail to apply to practical

use any idea or suggestion that seemed worthy of adoption, and who were at the same time endeavoring to work out for themselves some of the problems of the day. And, while many a good man has been able to live for years and to raise his family honestly and well on the proceeds of a shop conducted in some dingy cellar or shed at the back of his residence, neither of these could be classed as modern paint shops by any stretch of the imagination, and neither they nor the business conducted in them are the kind contemplated in the writing of this paper.

"The modern painting and decorating business generally has its headquarters or office conveniently located. Its store room, stock room and workshop may be in a back street, or in some out-of-the-way place, but is then connected by telephone to the office, and thus is in direct touch with it; but it is even better to have both office, store room and workshop under the one roof if possible.

"And further than that, the truly modern painting and decorating business will generally have in connection with its office a showroom for the exhibition of designs and other materials it is called upon to use from time to time; a laboratory for experimenting or testing materials; a workroom for the preparation of such materials as can be gotten ready before being sent out; a stockroom, with adequate shelving for the separation and ready supervision of the various articles in frequent use, a storage place for materials in bulk, and shelter of some kind for ladders, planks, and other tools; and last, but not least, a space wherein a separate locker can be maintained for every employe in the concern.

"The office of such a concern is conveniently located because, even with the telephone facilities made

use of so extensively to-day, the head of it finds many customers coming to see him (if he is accessible) where otherwise he would be compelled to lose valuable time in calling upon clients, who are perfectly willing to do the running, and even better pleased to visit his office, where explanations can be more readily made, samples of goods exhibited, more satisfactory conversations held and instructions given. Such an office generally includes a private compartment for the proprietor or manager, with suitable tables upon which sketches can be prepared or plans set out for convenience in estimating, and this compartment is so situated that its occupant can leave his work at a moment's notice and remain away for any reasonable length of time without any necessity for disturbing his unfinished work or feeling that others will be meddling with it during his absence.

"The showroom in connection with such an establishment is usually arranged with partitions or screens, so that several parties can be consulted at the same time without any danger of interference. This is a necessary as well as a profitable provision, as it is a hard proposition for a clerk in an establishment to interest one party in the selection of materials or a scheme of decoration for a small house or a few rooms, while in plain sight and hearing the proprietor is displaying designs and materials for decorating a mansion, and the contrast need not be, by any means, so great as that to make the situation difficult and embarrassing for all concerned. There is, therefore, ample provision made for the separation of all clients who may chance to need attention at the same time.

"The laboratory, so called, may consist of only a part of the stockroom or storeroom partitioned off, but is provided with means to raise the temperature in winter, and to protect any experiment that is under way; and is also fitted with a table of some kind, a Bunsen burner, small shelves for materials, and a few tools that may be found necessary in testing materials or making experiments.

"The workroom is light enough to facilitate the mixing of colors when necessary, and is provided with scales, weights, and measures, shelving for materials in use, and is so located as to be easy of access for the expressman or carter.

"The storage space and tool shelter may be ever so rough, but it is sufficient to protect its contents from the elements, and, like the workroom, moderately accessible, to prevent any waste of time and energy in carrying materials or tools to and from the wagon. The lockers, which are large enough to hold a hat and coat, a pair or two of overalls, a brush pot and a few other tools, are provided with a lock safe enough to form some protection to its contents, and one that is not a duplicate of the others. There is also in the possession of the proprietor an extra key for each lock, or a master key, that will open any of them, as otherwise some of the men often find it necessary to return home before they can get at their tools.

"It may be impossible to figure these lockers as a great money-getter, but they help to inculcate neatness on the part of the employes, prevent unpleasantness or hard feeling over the mislaying or changing of brushes or tools, and in this way they make their cost seem insignificant. These lockers also enable each man to be sure that his belongings cannot be interfered with if set aside for a few days.

"To further promote neatness and prevent the smeary appearance so characteristic of the old-time shop, some special place is oftimes prepared for wiping out of brushes, and for this purpose I could recommend no better plan than that illustrated in a copy of one of the trade magazines. It consisted of a shallow box, which could be nailed to the side of the building or wall, had several easily detachable boards on the back that could be removed when too thick with paint, and a door or cover on hinges, which could be kept closed to hide its unsightly interior.

"An establishment such as has been described, always supposing that it has the proper skill and experience at the back of it, and a proper complement of men—is ready at a moment's notice to carry out the wishes of a client in reference to almost any kind of contract, whether it be to finish the largest sky-scraper, to renew the finest of hardwood, or to decorate an interior in the most artistic manner; and is even able and ready to select and procure its furniture and fittings."

ORIGIN AND NATURE OF COLOR

WHAT we term color is not an inherent quality of any substance, but is merely the effect of sunlight touching that substance. In the absence of light there is darkness and no color. The sun shines upon grass, and the grass absorbs two of the three constituent rays of light, and reflects to the eye the remaining ray, which is a union of yellow and blue. It has taken in the red ray, and it is lost. If a substance should absorb all the three rays of light, it would appear to the eye as black, or without color. If a substance were capable of absorbing every vestige of the three rays we would not be able to see the black surface at all, or at most, it would appear as a very dark cavity. If, on the other hand, the surface of a substance were to reflect back the three rays of light, it would give the impression of white, which represents the complete union of the three rays of light.

Scientists are not agreed as to what constitutes the true theory of color, differing upon certain points. These various differences, while very interesting, need not be related here, for painters have not to do with the colors of the scientists, but with pigment colors, which stand for the prismatic colors. The first authorities on the subject gave red and blue as being the primary colors, from which all others might be produced, but the more modern idea is that the primaries are yellowish-green, pale crimson, and violet-blue.

The painter will, therefore, take red, yellow, and blue as the *primary colors.* The pigments which most closely approximate the prism colors are English vermilion, lemon chrome yellow, and cobalt blue.

Next come the *secondary colors,* namely purple, green and orange. Yellow mixed with red gives orange. Yellow mixed with blue gives green. Red with blue gives purple.

Then come the *tertiary colors,* produced by mixing any two of the secondary colors. Thus, green with orange gives citrine; orange with purple gives russet; purple with green gives olive.

The following arrangement of the grouping of the colors shows the theoretical value of the intensity, contrast, harmony and order of the various series:

Primary Colors	Secondary Colors	Tertiary Colors	Quaternary Colors
(3) Yellow	(13) Purple	(19) Citrine	(62) Auburn
(5) Red	(8) Orange	(21) Russet	(60) Drab
(8) Blue	(11) Green	(24) Olive	(57) Buff
Basic Color	Neutral Color	Normal Color	Broken Color
(1) White	(x) Black	(17) Gray	(33) Brown

An analysis of such a chart shows that the secondary colors are complementary to the primary colors, and that the quarternary colors complement the tertiaries. Furthermore, it will be noticed that the tertiary colors harmonize with the primary colors, and the quarternary order with the secondaries.

The intensity of the color is designated by a small figure on the left, and refers to the area attraction of that color. Thus, for example, three square feet of surface painted yellow will attract the eye with equal intensity as compared with eleven square feet of surface painted green. The weak point in the theory of

intensity is that black is represented X and is an unknown quantity, while the quaternary colors are so nearly alike that they need not be considered; nevertheless, the idea is good and helps to proportion the amount of color to be used in decorating.

In using the chart for practical purposes it is only necessary to bear in mind the following rule: Any primary color will contrast with one secondary, tertiary and quaternary color, and will harmonize in greater or less degree with two other colors of each order.

TABLE OF CONTRAST

YELLOW	contrasts,	Purple, Russet and Auburn
RED	"	Green, Olive and Drab
BLUE	"	Orange, Citrine and Buff

TABLE OF HARMONY

YELLOW	harmonizes with	Orange, Green, Citrine, Russett, Buff and Drab
RED	" "	Orange, Purple, Russet, Citrine, Auburn and Buff
BLUE	" "	Purple, Green, Olive, Citrine, Drab and Auburn

White, mixed with any of the positive colors, produces tints, and the rule for contrast and harmony holds good in such cases, as will be seen by adding white to a primary color and its complement. Thus, white and yellow mixed together give a pale canary yellow, which is a beautiful contrast to the delicate lavendar made by mixing white and purple.

Black mixed with a positive color produces shades, which have a tendency to tone down the color. With yellow it gives bronze-green and olive tones; with red, a series of red-browns; with blue, a blue-black and grey colors.

Normal gray is a mixture of white and black; neutral grays are admixtures of black, white and any

of the positive colors. Therefore, whereas we have only one normal gray, we may have an indefinite number of neutral grays.

In conclusion it may be stated that there are about 144 distinct tones of color and fully 13,000 associated tints.

COMPLEMENTARY COLORS.—A complementary color is one of the three primaries contrasted with a mixture of two other of the primary colors. Thus, *red* is the complementary of yellow-blue or green; *yellow* is the complementary of violet, which is a mixture of red-blue; *blue* is the complementary of red-yellow or orange.

THE PROPER RELATION OF COLORS.—A color stands in relation to another color or series of colors according to a fixed scheme. Color charts are formed to show this relationship, and such a chart will show red opposite green, yellow opposite violet, and blue opposite orange, and so on, with every degree of color, according to its nature. Opposite black is placed white, representing complementary contrast.

COMPLEMENTARY CONTRAST.—The complementary of any color is also its exact opposite; hence, complementary colors are *contrasted colors,* because they contrast fully.

LUMINOUS AND SOMBER COLORS.—Yellow is in the luminous class of colors, and blue in the somber class, whilst the reds belong in an intermediate class.

PURE AND BROKEN COLORS.—Red, blue, and yellow are called *pure colors;* mix any other color with them, and they are then known as *broken colors.*

HARMONY AND COMPLEMENTARY CONTRAST.—Color harmonies are of several kinds, the most important being that of *harmony of complementary contrast.* Looking at red until the eyes tire it loses its brightness, and then if we will let the eyes rest upon green for a few moments or until the eyes become rested, and then turn to the red again, we notice how bright it is again. If we place colors close together, as red next to green, the one improves the other, and it is the same with all colors. The influence of color upon the eye is to render it partially insensible to that color, and the eye is rested by looking for a time upon its contrasting color. Again, if after the eyes have become tired from gazing on red, we turn to a piece of white paper, we shall see there a green image of the red object.

SPONTANEOUS CONTRAST OF COLORS.—When colors are placed beside each other the effect is the same as when they are viewed separately; the contrasted colors are enhanced in color by the contrast, caused by the equal action of both colors upon the eye at the same time. When the color is viewed alone it is vitiated by the rays that come to it from the opposite colors. But, when we place two colors side by side, as red and green, these reducing rays are neutralized, the complementary of each being thrown upon the other.

HOW CERTAIN COLOR COMBINATIONS INJURE ONE ANOTHER.—The mutual effect of colors most contrasted is to intensify and exalt each other. On the other hand, the effect of placing together those colors which are nearly alike is seen in their injury. If we place violet beside yellow, the effect is to make the

yellow still more yellow. If we place the violet beside other colors, the effect is to vitiate them by yellowing. It will make green yellower, because green is already half yellow; and, beside violet, orange becomes greenish-yellow. Violet placed beside orange produces a yellowish-green; orange and green being half yellow, the additional yellow will not be so marked as in the case of the colors not having yellow; violet, beside blue, produces a blue effect upon both. Red it changes to scarlet. A rule to remember: A color placed beside another color tends to make that color as different as possible from itself.

Contrast of Tone.—Place a strip of black paper beside one of white, and the effect will be to increase the contrast between them. This applies to all intermediate tones of white and black. Take strips of paper painted in various shades of grey, from very light to very dark, and place the edges of any two strips together, and they will appear darker on the edge next to the contrasting slip; the light tones will appear lighter, and the dark tones darker. This is also true of any two colors placed together, they will alter each others' intensity. Thus, place a dark red beside a light rose color, and the light tones in each will seem brighter, and the dark tones darker, as if they were pushing one another apart as far as possible. Chevreul says: "In the case where the eye sees at the same time contiguous colors, they will appear as dissimilar as possible, both in their optical composition, and the height of their tones."

Harmonies of Analogy.—These may be produced in three different ways: First, we may arrange the tones of a single scale in a series, beginning

with white and ending with brown-black, leaving as nearly as possible equal intervals between them. This will produce a pleasing result. The greater the number of tones, the finer will be the effect. Second, we may associate together the hues of adjacent scales, all of the same tone, and often produce an agreeable analogy. But, sometimes colors of near scales mutually injure one another, as blue and violet; the complementary of blue, which is orange, being thrown upon the violet, gives it a faded and blackened appearance; while the complementary of violet, which is yellow, falling upon blue, gives it a green cast. Yet in some certain cases we may sacrifice a color in order to give prominence to another. Third, a pleasing harmony of analogy is produced by viewing groupings of various colors through a colored medium that casts its own peculiar hue over the whole, as when the light from a stained glass window is cast upon a carpet.

Effect of White Upon Colors.—In connection with white, all colors appear brighter and deeper, the superior brilliance of white rendering the eye insensible to its light, so that we do not notice its weakening effect upon the color. At the same time the white is vitiated by contact with the color's complementary falling upon it. White is so intense that in all its arrangements with color, excepting, perhaps, light tones of yellow, there will be no contrast. It is for this reason that we use it for separating two discordant colors. All the primary colors appear to better advantage when used in connection with white, though not in equal degree, the height of tone of the color making a decided difference in the result. The deep tones of red, blue and green, and violet contrast

too strongly with white, while the light tones of the same colors form with it very agreeable contrasts. Orange, the most brilliant of the colors, is almost too intense with white, while the deeper tones of yellow appear well with it.

Association of Black With Colors.—Black and its shades of gray associate agreeably with most colors, making them by contrast lighter, while the complementaries which are thrown back upon the grays and black have no appreciable effect, as black reflects so feebly. With the deep tones of the scales it forms harmonies of analogy, although their luminous complementaries, especially those of blue and violet, when falling upon black, rob it of its strength, making it appear faded. Where white gives too strong a contrast, gray, being intermediate, may be used; and black makes the combination too somber, as with violet, green and blue, and green and violet.

WHITE LEAD POISONING

HERE is one infallible sign of white lead poisoning, namely, a blue line around the gums. But the poisoning shows itself in various ways. Colic is frequent, paralysis and other nervous disorders often occur, the blood is anæmic, or poor, gout and Bright's disease of the kidneys are to be looked for, and disturbances of the generative organs may be produced. Painters' colic is the name given to the spasmodic attacks of intense, griping pain which begins at the umbilicus (or naval). The exact way in which the pain is produced is not known, but the intestinal secretions appear to be diminished, there is spasmodic contraction of the intestinal walls, and there is constipation. Firm pressure on the abdomen somewhat relieves the pain. These attacks may last, even under treatment, for several days. A full dose of laudanum with an ounce of castor oil usually gives relief.

The nervous evidences of lead poisoning are of most interest to the physician. The lead, strange to say, prefers to attack certain nerves to the exclusion of others. Thus, the nerves going to the muscles which extend the hand and fingers, become weak and waste away, at times there is pain when they are pressed, and finally they become paralyzed.

This paralysis gives rise to a peculiar deformity known as "dropped wrist," in which the hands hang down, and the patient is unable to raise them. Other arm muscles are sometimes attacked, and occasionally the legs are affected. This is the commonest form of lead paralysis, and if taken in hand early in the disease, there is a prospect of rapid recovery under medical and electrical treatment.

Sometimes, however, more severe nervous symptoms present themselves. Thus, the brain may be attacked, and as a result paralysis of one-half of the body, convulsions, delirium, coma, blindness, and even death may occur. Insanity also occurs. Eye symptoms are often met with. Inflammation of the optic nerve, unequal pupils, hemorrhages into the retina, and blindness are sometimes met with.

The blue or slate-colored line which appears in the gum close to the teeth is an important sign that lead has been taken into the system, either by way of the stomach, the lungs, or the skin. It is due to a deposit of the sulphide of lead in the tissues, this sulphide being formed by the union of lead circulating in the blood vessels, with sulphur provided by food and the "tartar" at the edge of the gum. It may be the only sign of lead poisoning present. Sufferers from lead poisoning generally suffer from anæmia or poorness of blood, and have a pale, sallow, earthy look. This is usually the first symptom.

Lead poisoning is soon apparent to one having it, and it takes very little lead to produce lead colic. But, before a man reaches the dangerous stage, he usually has three or four attacks. Some say that the colic has been contracted by reason of lead paint around the finger nails, but this is not at all probable, unless the skin should be broken and so admit the lead.

Single doses of lead produce few symptoms of poisoning unless the quantity is large, and even then fatal results do not occur. Frequently repeated small doses of lead produce the characteristic poisoning by lead. A single dose of lead will not produce the disease. The lead is taken into the body through the mouth and swallowed, which may be regarded as

practically the sole source of lead poisoning. The lead is either borne by the air to the mouth as dust from dry powdered lead compounds, or particles of lead adherent to the fingers are conveyed to the mouth with the food. In these cases the lead is swallowed and carried to the stomach, whence it is absorbed into the blood. A man who handles a pipe and tobacco is also liable to get leaded. Danger from these sources may be prevented. In working where there is lead dust, it is scarcely necessary to wear a respirator. It is quite sufficient if the mouth is washed out and the teeth cleaned. It would not be advisable to drink without first washing the face and cleaning the mouth and teeth. To produce lead poisoning, the doses need to be repeated and long continued. There is no case on record of a single dose of lead poisoning producing fatal results.

It is doubtful whether lead dust inhaled through the nose can be absorbed through the lungs. Lead dust borne by the air must be swallowed before it can be absorbed. It is equally doubtful whether lead can be absorbed by the unbroken skin. Volatile inorganic compounds are not known, so that poisoning by lead vapor, unless at very high temperatures, is improbable. Most lead compounds, such as those forming paint, can be heated to redness and cooled again without losing weight. Only at temperatures above and near the point of liquefaction are vapors present. Lead vaporizes at 1110° F., or a temperature of 65 times as high as boiling water.—Dr. H. B. Chapman.

To get lead out of the system, one must wear clothes that are scrupulously free from lead; practice extreme personal cleanliness; take a Turkish bath twice a week. He may also take three grains of

iodide of potassium and five grains of carbonate of soda twice a day in a wineglassful of water. For the constipation, castor oil is the best remedy, but as soon as the lead is eliminated from the system the constipation will cease. It is due to a form of paralysis of the intestines. Various theories as to taking sulphates to make the lead insoluble, have been constructed; but they are all a delusion, and only add to the evils caused by the lead.—James Edmunds, M.D.

Preventive for Lead Poisoning

Dr. W. A. Johnston, who has acquired experience as a physician in lead smelting works, sends a communication to *The Lancet,* recommending the following as a mixture for free use among the workmen exposed to lead poisoning, which has, in his experience, answered better than any other drink:

Sulphate of magnesia	10-30 grains
Dilute sulphuric acid	½-2 minims
Spirits of nitrous ether	1-4 minims
Water	½ oz.

To be taken every three hours while exposed to the lead. In the works where he practiced, he says, before this mixture was used there were from one to twenty cases of lead poisoning daily, but subsequently no case occurred for the six weeks during which he provided the medicine.

Small doses of sulphur—milk of sulphur—in milk taken in the morning are also valuable, as sulphur forms insoluble compounds with the lead in the stomach. Epsom salts and Carlsbad salts in small dose can also be used for the same purpose. Prevention is, however, better than cure, and a little care will obviate the need of any substance to make lead insoluble.

Can a Painter Be Healthy?

Yes, provided he observes a few simple rules. Turpentine poisoning and lead poisoning are the greatest of paint maladies. Neither lead nor turpentine are injurious by contact with the outer skin. Their deadly mission is accomplished when breathed into the lungs, taken into the system in the form of dust, or by open sores coming in contact with them.

Turpentine is a severe toxic poison. It accomplishes its deadly mission when its vapor is inhaled. Urinary troubles, inflammation of the eyes, lung trouble, kidney disease, and many other ailments can be traced directly to the effect of turpentine poisoning. As turpentine substitutes are even more volatile than turpentine, giving off greater amounts of still more poisonous vapors, it is obvious that no remedy can be sought here.

If used with ordinary care, lead is harmless. Long and continued carelessness is necessary to make it poisonous to the human system. It must be absorbed steadily for a good length of time before it is harmful. German chemists claim that one-sixth of a grain each day is sufficient to bring on the most virulent forms of poisoning. Only when the dust from dry paint is allowed to enter your stomach in connection with food or tobacco, or is breathed through the nostrils, does lead accomplish its deadly work.

Ventilation and cleanliness will prevent poisoning. The greatest danger lies in taking lead into the system through the mouth. Keep yourself immaculately clean when you eat. Avoid smeared hands and overalls. Wash your hands and face and change your clothing before eating. Never partake of food nor tobacco with lead-smeared hands. on the job.

Health Hints for Painters

1. Avoid spattering, for it is dangerous as well as unpleasant to be continually enveloped in robes of poisonous paint.

2. Never attempt to eat or sleep without first washing the hands and face and rinsing the mouth.

3. Keep the buckets, brushes, etc., clean, so that they may be handled without smearing the hands.

5. Every painter should wear overalls, or change his clothing throughout, once a week at least, in the meantime thoroughly airing those he has thrown off.

6. Keep the shoes clean and well ventilated.

7. Never sleep in a paint shop, nor in a newly-painted room, nor paint the walls of any room with any of the metallic greens.

8. Never suffer the paint to accumulate upon the clothing, nor upon the finger nails.

9. Never wash the hands in turpentine, as it relaxes the muscles and injures the joints. Any animal oil, or even linseed oil, is better.

10. Never drink water that has stood in a paint shop or in a newly-painted room.

11. Never use spirituous liquors, especially when ailing from the effects of paint, as it unites with the mineral salts and hardens them, and causes inflammation of the parts where they concrete.

12. Milk, sweet oil, and the like, should be used freely, as they tend to soften the accumulated poisons and carry them off.

13. Vinegar and acid fruits, used constantly, unite with the lead that may be in the stomach, chemically changing it to the acetate or sugar of lead, which is by far the least dangerous. Acetate of lead is scarcely recognized in medical jurisprudence as a poison.

QUESTIONS ANSWERED

ELLOW PINE ENAMELING.—A room was enameled white on yellow pine, and in three years it had become quite yellow, full of dirty-looking streaks, and very rough. How restore it? Yellow pine is a very poor wood to enamel on. Remove all the old paint down to the wood, then sandpaper smooth, apply a coat or two of white shellac, rub each coat with fine sandpaper, then apply several coats of flat white paint, all but the first two made of zinc white. Sandpaper each coat. Finish with a coat of white enamel paint. Rub off with curled hair or moss, and flow on a coat of white enamel varnish.

TO SLOW UP ENAMEL PAINT.—A tablespoonful of coal oil to the gallon of enamel paint will cause it to flow well and spread easily under the brush, without injuring the gloss. The kerosene retards drying, slowing it up, so that it will not harden for two or three days. Stir the coal oil into the paint very thoroughly. If necessary a larger proportion of the oil may be used, but care must be taken to stir it in slowly and thoroughly.

RE-FINISHING ENAMELED WORK.—The old enameling is in fair condition, the white a trifle yellowed, and there are a few open joints in the woodwork. How can the work be done at least time and expense? What kind of putty for the open joints? Rub down the old work with pumice stone and water, use a white lead putty, and finish with a coat of enamel

paint. If this does not give a solid job then rub off with curled hair or a little pumice-stone powder and dry rag, to remove gloss, and apply another coat of enamel paint. Flow it on full and free, being careful that it does not run or sag.

Flat or Gloss Undercoat for Enamel Paint?—An ordinary flat coat will be absorbent, hence will cause the gloss finish to lose some of its luster. And yet a flat ground is the logical one for a gloss finish. It is less liable to soften or expand and contract than an oily coat, and if not too hard a coating it takes the finishing coat of enamel better than a gloss undercoat would. Yet some think a glossy undercoat helps a finish coat to bear out better, which is a mistake, for enamel paint is liable to soften an oily undercoat and to sink in. A hard, non-porous, well-bound surface is best for an enamel finish.

Enameling Old Bath Tub.—A copper lined and tinned bath tub is to be coated with white enamel paint. First, clean off the surface with ammonia water, to remove all grease and dirt; sal soda water will also do. When clean and dry apply a coat of flat white paint, oil and turpentine about half and half, with a little best japan drier. When quite dry, rub with fine sandpaper, clean off, and apply another coat of flat white, with more turpentine than oil, or very little of the oil. If this is to be the last coat before the finish, then add no oil at all. Sandpaper, and apply the enamel paint. One coat will do.

Should the Paint be Stirred Before Using?—If the contents of the can of enamel paint is not shaken up and well stirred, the liquid portion will be at the top and the pigment part at the bottom or be-

low the top somewhere. When strained well at the factory there will be little sediment at the bottom of a can of paint, otherwise, the grit will go to the bottom, and should not be allowed to get into the coating. It would be well to pour off the contents of the can, into another clean can, thus leaving the coarser sediment with the first can. Then the second can may be well shaken and used.

To Prevent Sagging of Enamel Paint.—Enamel paint is liable to sag on a vertical surface, if the ground coat is not a dead one, hence, to avoid it the surface should be lightly rubbed with curled hair or pumice stone and water, then rub with a little soap on your pad, dipped into the pumice also, then wash off with clear water, rub lightly with rottenstone and water, and wash off. Some trouble, but for a first-class job it will give a nice result, taking the enamel in good style.

To Make Enamel Paint Work Easy.—Thin it out with benzine, which will allow of easy flowing and spreading, but will not injure the enamel, evaporating completely and leaving a thin coat of the paint, no laps showing. A few drops of glycerine in the paint is liked by some, or a small quantity of alcohol, while others prefer a tablespoonful of coal oil to the gallon of paint.

China Glossing.—First, or priming coat, mix white lead with equal parts of oil and turpentine. When dry, sandpaper smooth, dust off, and second coat with white lead thinned with turpentine only, and a little drier. Let dry, sandpaper, dust off, and third coat with zinc white thinned with turpentine

and adding a little damar varnish to bind. Fourth, coat, zinc white mixed with damar varnish, and flowed on. The third coat should be completely dead flat; it would be best if ground in damar varnish, and if necessary, thin with a little turpentine, using as little as possible, so as to avoid injuring the gloss. If the work is new white pine, shellac it with white shellac, very thin, for a first-class job. Sandpaper the shellac coat. The best work calls for six coats in all. Get the work smooth at the start, and keep it that way.

To Remove Yellow Cast from White.—White paint thinned with any amount of linseed oil will turn yellow unless exposed to sun and air, as on exterior work, where the sun bleaches the oil. Ultramarine blue is commonly used for giving a cold, white cast to white paint, but it rather inclines to give it a greenish cast. If you choose ultramarine blue for the purpose, then get the one that has a violet hue, rather than the one with the greenish hue. True lampblack would probably be better than the blue, but it must be made from oil and not the carbon or gas black. Drop black tends to increase the yellow cast, rather than diminish it.

Is Raw or Boiled Oil Best?—Raw oil is more porous than the boiled, allowing the air to pass through it more rapidly. It dries from the bottom up, or from the inside, and it takes longer to dry away from dust and other dangers. Boiled oil dries from the top down and through, so that in a brief time it has a skin formed on it, which is so-called air-tight. It dries quicker than raw oil, but, owing to its exclusion of the air, takes longer to reach the resinous state,

and on that account is said to be more durable than raw oil, or better weather resisting.

Why Grained Work Sometimes Cracks.—Experts have given various opinions. Some say it is due to a green varnish being used, others that the graining color was fatty. Or, the ground color had too much oil. The best foundation for grained work is to be made with pure white lead tinted with finely ground oil color and thinned with turpentine and driers only, so that the paint will dry perfectly flat. Use freshly-made graining color, use none that is over forty-eight hours old, and if made fresh each day, the result will be surer. Never thin up with oil, as the lead and pigment or tinter contains oil enough to bind the paint. Allow the grained work to stand at least two months before applying any varnish, and for outside work it is advised to use oil, well rubbed in, rather than varnish. Never use a heavy-bodied varnish on grained work. Use a light body varnish, one containing plenty of turpentine.

Paint for Exterior Use.—The sunny side of a house will require a paint containing rather more oil than is required on the north or shady side, and rather less driers.

Less paint and more painting should be the golden rule. The least paint applied at each coat, consistently with the proper covering of the surface, the better the result as to wear and appearance.

To have a harder drying paint it is only necessary to use less oil and more turpentine, adding some hard copal varnish. Japan color may be used in such a paint, and will assist in giving a hard paint coating. Such colors will dry hard in an hour, and failure to do so indicates something wrong with them.

Good exterior work calls for three coats, and cheaper work does with two. Thin coats are to be preferred to heavy, and all paint should be well rubbed in. Paint wears better if well brushed out.

How to Tint Paint.—First, have a paint mixer, a machine. The way to mix by hand is to thin the white lead down with oil, a little at a time, until you have a smooth, stiff paste. Then add the tinters and mix thoroughly with the paste lead, making the color as near as possible to the tint desired. By adding color to the paste lead you can add a very small amount at a time and get the desired shade, but by thinning the tinter first, before adding to the white lead, you have some trouble in getting the right tint and in mixing the tinter perfectly. After getting the desired tint strain the colored paste paint. If you undertake to tint the thinned paint the oil in it will so affect your tinting color as to render it difficult to secure what you wish, the color will be yellowed.

Is Boiled Oil Right for Priming Coat?—No, use raw oil only, whitened with a little lead, adding a very little of the best japan driers. Boiled oil makes a more lustrous finish than the raw. In former days we primed with raw oil, and for second coat used raw and boiled oil, equal parts, while the third and last coat was thinned with boiled oil entirely, and that gave a fine gloss job. But we boiled the oil in the shop. Exterior painting done this way lasted well for fifteen years.

Fireproof Paint for Roof.—A correspondent gives the following as his favorite formula: Slack some fresh lime in a barrel so that it will become pow-

dered; do not add too much water. Sprinkle water over it from time to time until it falls into a powder. Sift it fine, and to each six quarts add one quart of salt and one gallon of water, then boil and skim. To each five gallons of the liquid add a pound of pulverized alum, half-pound of pulverized copperas, and, while stirring the mass add also 12 ounces of potash, then fine ground sand, four pounds. Add any desired coloring that will agree with lime and apply with a fiber brush. This makes a very nice effect, better than slate in appearence, while quite as durable. It will also stop leaks in a roof, prevent moss and decay, and renders the shingles fireproof.

Does Kerosene Oil Make Colors Clearer and Brighter?—Some painters say it does, but the statement is without foundation in fact. No volatile thinner, such as turpentine, benzine or mineral oils, has the power to make pigments or colors clearer.

What Are the Effects of Coal Oil in Paint?—It is a non-drying oil, and has no adhesive qualities at all. It is not oxidized or changed, nor will it combine with other materials under ordinary circumstances. Therefore, it is valueless in paint, deleterious when mixed with linseed oil, as it retards or even prevents drying of paint. Neutral petroleum oil will cause paint that is placed over a coat containing it to crack and peel.

Should Paint Be Mixed Fresh Each Day?—No, though it is right to break up the lead into a stiff paste, ready for thinning, but the thinning should be done 48 hours in advance of the using of the paint. By leaving it have, say two days, to get mellowed in,

it will wear better than fresh made paint, and have a better luster. But, if mixed too long it becomes fatty or oxidized, losing in covering power, and being liable to blister under the action of a hot sun. If the lead is broken up at least 24 hours before being thinned it will absorb additional oil, as much as a gallon to the 100 pounds of lead. A correspondent says that when possible he breaks up his lead at least 30 days before using it, and finds it goes farther and produces clearer colors. What it actually does is to spread better, but cover worse—quite a difference. The colors appear clearer because the paint has become more or less fatty, hence the paint will have a glossier look than fresh paint, and the colors will look brighter.

Rule for Use of Driers.—No set rule can be laid down for using driers in paint; the amount used should be a matter entirely for the mixer to settle. There is such a wide difference in conditions of weather, surface, kind of paint, drying quality of pigments, oil, lead, zinc, etc., that it is obvious that only the painter on the job can determine what quantity or kind of driers had best be used for that particular work. And the same is true of the proportion of oil to use in a paint; in fact, the entire subject is one for the painter himself to determine, and is not to be set down in print.

Repairing Cracked Wall.—Plaster of Paris and glue size makes a good putty, but is apt to shrink some. If it is used, then shellac over it, first sandpapering smooth. A hard glazing putty is better, mixing white lead and whiting with a little varnish and japan. Large cracks must be cut out and keyed, or

enlarged, with the inner part wider than the outer, in order to hold the plaster. As the plaster will shrink in drying it will be necessary to apply another coat over it, and, when dry, sandpaper smooth and shellac. For an old wall, where one side of the crack may be higher than the other, use the French method: mix white lead and coach japan to a stiff paste and apply with a broad glazing knife, levelling it so that the low side will be like the other. Sandpaper smooth.

Mixing Pot of Paint.—What is a good composition for a bucket or pot of paint, white, inside use, next to the last coat? Take of pure white lead, 8 lbs.; best zinc white, 8 lbs.; turpentine, 13 oz.; white japan drier, 2 oz. This will give very close to 11 pounds of paint, ready for use. Strain it, and this may cause a loss up to 8 ounces of skin, etc.

Mixing a Priming Coat of Lead Paint.—The proportion of oil per 100 lbs. white lead for priming varies with different painters, some using 5 gals., others as much as 7 gals. Some add turpentine, say, one-half gallon, in which case a like amount of oil is omitted. Much depends upon conditions, time of year, condition of weather, character of the wood, etc. In cold weather and damp weather, more driers will be required than in dry or summer weather. Priming paint is better with very little or no driers, as too quick drying prevents proper saturation of the wood. Some use zinc white with the priming, why, we do not understand, but in such case use more driers, as zinc is a poor drier. Never use boiled oil in priming. We prefer to use freshly mixed priming.

Pigments Affected by Lime or Alkali.—White lead and all pigments made on a lead base, such as yellow chrome, or containing any lead in their composition as Prussian blue, vermilion, emerald green, cadmium, rose pink, the lakes, and most vegetable colors, are affected, such as madder, indigo, etc.

Pigments Safe to Use With Lime, Etc.—These are silica and similar inert whites, zinc white, yellow ochre, zinc yellow, Venetian red, iron oxide, Indian red, English vermilion, chromium oxide, lime green, terre verte, ultramarine green, raw umber, burnt umber, raw and burnt sienna, cobalt and ultramarine blue, lamp and carbon black. The regular lime-proof mortar colors are zinc white, yellow ochre, Venetian red, lime green, iron oxide or mineral paint, ultramarine blue and lampblack.

Pigments Most Permanent to Light.—All of the whites, all of the blacks, except black lake, yellow ochre, medium and orange chrome yellow, Venetian red, iron oxides, American vermilion, chromium oxide green, terra alba, lime green, zinc green, medium chrome yellow, raw sienna, raw umber, cobalt and ultramarine blue.

Touching up Jobs.—When touching up an old, straw-colored surface, make the color as near the original as possible, then add to it a few drops of asphaltum, which will impart the dirty or stained appearance of the old paint. An old vermilion job may be touched up with vermilion stained with a little Venetian red. Asphaltum will give a dirty look to white, cream, pearl or silver gray, buff, and any color containing white.

BLACKBOARD SLATING.—A very large number of formulas for blackboard slating may be had, and of these we give here the most useful:

QUICK DRYING SLATING.—Dissolve 10 oz. orange shellac in 2 qts. of alcohol; stir briskly and add 2 oz. best calcined lampblack, 3 oz. best ultramarine blue, 6 oz. powdered rotten-stone, 8 oz. flour pumice, and continue stirring until the mass is perfectly smooth and free of lumpy particles. Run through a fine strainer and cork tight for use. Apply with a wide and soft brush, and be quick about it, or the work will show laps. Several coats will make the best job.

SLOWER DRYING SLATING.—Take 1 lb. drop black in oil, $\frac{1}{4}$ lb. ultramarine blue in oil, and 1 lb. fine emery flour, and stir into a paste; then add $\frac{1}{2}$ gal. coach japan, stir to smooth paste, and add a pint of turpentine, after which pass through a strainer and apply. In place of emery flour you can use flour pumice stone.

CHEAP SLATING.—Take of lampblack in oil 4 lbs., ultramarine in oil 1 lb., and 1 lb. flour pumice stone. Mix and thin with turpentine, adding a little driers. Being thin it is easy to apply. Or, beat up some japan drop black in varnish and add powdered rotten-stone, enough to flatten the paint, and thin up with turpentine.

GREEN SLATING PAINT.—In all cases to get a nice job of slating, the surface should be made smooth and even all over. Then apply too coats of this: A pound each of Prussian blue and medium chrome green. Thin out with equal parts of oil size and al-

cohol to the consistency of thin cream. Use a wide, stiff-bristle brush. After 24 hours or so smooth off with a piece of felt, then apply a second coat. Shade may be changed by varying the proportions of blue and green.

Bleeding Red.—Mr. Kevers, a master painter, says that a coat of shellac will effectually prevent this color from striking through. He adds: In applying any kind of red, either bleeding or non-bleeding, it is safest to give the work a coat of ground color, composed of three parts Venetian red and two parts zinc white. In case of varnished finish, of course, the ground color must be flattened, and the finishing color should be ground in coach japan.

What Is Chamois Skin?—Chamois skin originally came from the chamois animal, which is now practically extinct. So-called chamois skins have for years been made from sheep skins tanned and colored to resemble real chamois skin, and they have thus been sold under the name of chamois, and are still so sold. There are good and bad grades of these imitation chamois skins, the best being selected from the finest sheep skins and carefully tanned and colored. These can be washed when dirty, and will remain firm and soft. Sizes will run from 12x14 inches up to 26x28 inches, weighing from three ounces up to six ounces per skin. Prices will in a general way range from 25 cents up to $1.25, according to size and weight. This is for best grades.

Evaporation Points.—The vapor tension or rate of evaporation of methyl alcohol (wood spirits) is twice that of ethyl alcohol (grain alcohol). The rate

of evaporation of acetone is twice that of wood spirits. Grain alcohol at a temperature of 104° F., is just equal in point of rapidity of evaporation to that of turpentine at the boiling point of water.

Painting Over Tarred or Creosoted Work.—If the stuff is old and well absorbed into the wood, a coat or two of brown shellac will be sufficient. If the case is a bad one, and you have to paint white or very light over it, try this: To 14 lbs. of best zinc white in paste form add three half-pints of benzol and a gill of common copal varnish. Mix well together and apply two coats.

Painting Over Creosote Stain.—If there is anything which will prevent creosote stain from coming through enamel or paint when the paint is applied over the surface previously stained, it is, in our opinion, a coat of good shellac. Creosote, of course, has great penetrating power, but we think the shellac, if allowed to dry thoroughly before putting the paint on, will accomplish the desired result.

Painting a Background.—To ordinary hot paint add a hot solution of soap, and mix together; use when cool. This gives a dull surface and will not crack.

Imitation Gold Color.—Take flake white ground in varnish and tinted with lemon chrome yellow and a touch of vermilion, and you will have a good imitation of gold paint. Gold paint color may also be bought in tubes, ready for thinning for use.

Useful Cheap Paint.—To make a cheap and yet very good paint for many purposes, take 150 lbs.

bolted whiting and mix to a paste with water; then add 6 gallons of hot soft soap; now break up 60 lbs. of white lead in three gallons of boiled oil, and when mixed to a paste add three gallons more of oil, then stir the lead and whiting mixtures together. The mass should be run through a hand-mill—something that should be in every paint shop.

Yellowing of Inside White Paint.—The old-time painter always put some oil in his flat inside white, and the result was a case of old ivory-white. The old-time parlor was always white when first done, and it was kept dark most of the time, so that between the dark and the oil in the paint the woodwork became yellow. Such a room can never be made a pure white again; and if you come across a case of the kind here is a hint that will help you out—give the work a thin coat of shellac. This is not absolutely certain, but the next thing to that. Without the shellac the yellow will come through the new paint.

Turps in Exterior Paint.—Turpentine may be employed when the oil is old or fatty, and then only in the proportion of about one part of turps to eight parts of oil. Its use should be avoided for finishing coat outside work, for it adds absolutely nothing to the durability of the paint; it simply serves to extend or thin the linseed oil with which it may be mixed, thereby impairing the durability and elasticity of the oil. Turps makes the paint work more freely, *i.e.*, an easier job for the painter, but a less durable one for the owner.

To Paint Canvas Without Destroying Its Flexibility.—In a quart and a half of water put two

ounces of white vitriol and into this solution mix whiting until a brushing consistency is reached. Over this use an elastic paint in one or two coats. Again, dissolve white beeswax in turpentine to a soft butter consistency. To a pound of Florence or zinc white add ¼ pound of this beeswax and add a teaspoonful of soft soap. Knife this on to the canvas, and in due time follow with elastic coats of paint. Canvas, drill fabrics, or cloth, may be treated as above, and when dry they will be found to roll up nicely.—*Carriage Monthly.*

Fireproofing Shingles.—Any good mineral paint, mixed in the usual way with oil, will make a more or less resistant fireproof paint. The danger to a dry shingle roof lies in its quick readiness to blaze from a small spark. Having lost a house by this means, we speak from experience. A spark may fall on a painted shingle and do no harm, for its heat will die in a very little time. Lime water or whitewash is, however, about one of the best fire-resisting coatings for a roof that we know of. It may be prepared in various ways, with sand, etc., but if the shingles are well saturated with strong lime water, not necessarily whitewash, it will prove resistant to ordinary sparks, etc.

Finish for Kitchen Woodwork.—As an ideal treatment for kitchen woodwork a contemporary recommends white or cream enamel. This will be found to keep clean longer, to clean more easily, and always look cleaner than any other treatment. Next to this it will be found that a light oak graining, well varnished, has claim to consideration, chiefly on account of appearances. It will not look dirty even

when it really is so, and it will not show scratches, chips and dents, the inevitable result of hard wear in the aggravating fashion that plain color does. It will be difficult, it adds, to convince the average lady that white woodwork will not look dirty, and can be kept clean with less labor than buff or stone color. But, if consent is obtained for practical experiment, after a few months you will have equal difficulty in persuading her to the contrary.

Paint Spotting.—A house painted drab went spotty; what caused this? The fault lies in the wood, whose texture is uneven, sappy, or with soft places that take up all the oil from the paint. If, when you prime a job and leave it long enough to tell, these spots show more or less distinctly, you may be sure there will be trouble in the finish. It may be avoided by giving the wood all the oil it will take, say it is applied after the thin priming coat has been given. Another way is to paint over the spots, and then, when dry, give the entire surface the regular coat. In this way the soft spots will have been filled and the whole surface will present a uniform texture for the paint.

"I painted a house a medium shade of gray made from pure white lead in oil and dry lampblack, thinned with oil. In about six months the house had turned white in several spots, and the paint was in bad condition. Looked as if the house might have been painted for years.

"I knew my materials were reliable and could not understand what the trouble was. I was deeply concerned and tried several experiments in my shop to discover the trouble, if possible. I found that my mistake was in using dry lampblack for tinting. The

dry lampblack does not mix intimately with lead and oil—it becomes lumpy—and if the surface on which the paint is applied happens to be more dry and porous in some spots than others, spotting soon begins. I had no further trouble of this kind after using ivory drop black in oil for producing gray tints, and this is a point painters should remember.—*Carter Times.*

DEFINITION OF PORCH, ETC.—A porch is a covered entrance to a building, commonly enclosed in part, and projecting out from the main wall with a separate roof. It may be large enough to serve as a covered walk. Portico means the same thing, but is an obsolete term. Veranda is a local U. S. word for porch. Piazza means a place, a square, a market. An open square in an Italian (sometimes other European) town, especially the largest, or an unusually large one, as when a smaller one is called *campo, piazetta,* or the like. In the 17th century the open square in which is now Covent Garden market, London, the decorative arcades on the square were called especially, "the piazza."

By extension, an arcaded and roofed gallery, such as often surrounded a true piazza; also, a portico or single colonade before a building; whence in the United States, a verandah.—*Vide* Webster's 1912 Dictionary.

PERMANENT GREEN PAINT.—If you desire to paint anything green that will be exposed to the weather, such as lawn furniture, etc., you will find medium chrome green to do fairly well, but emerald green is even better, it being tolerably permanent, more so than any other of the green family. Yet it is more or less affected by sulphur and impure air.

When we paint a door we like to remove the escutcheon, etc., so that they will not get smeared with paint, but when this is not feasible we cut out a card to fit the part to be protected, and thus save time and work. When the fittings are full of old paint it is best to take them off and soak them in some sal soda water until the old paint loosens up, after which they can be cleaned and put back again.

One of the most useful tools about a paint shop is the paint strainer, and is is a sign of good workmanship—for the man who strains his paint is a careful painter.

For smoky wall or greasy wood, apply lime-wash before painting.

Turpentine deadens the luster of paint, and its excessive use is one cause of peeling.

Silicate paints are used for fireproofing wood, paper and canvass. They are very adhesive and set quite rapidly. Owing to their alkaline character they cannot be used with colors or fabrics affected by alkalies.

Pine tar may be thinned with turpentine spirits, as may also a mixture of lime and coal tars; but coal tar can only be thinned with what is known as light or creosote oil.

Painting damp wood imprisons the moisture, which will rot the wood beneath the paint. For the same reason never lay linoleum on a damp floor.

A clean cloth, dipped in hot water, then a saucer of bran, will speedily clean white paint without injury to it. The soft bran acts like soap on the dirt.

Putty all nail holes and imperfections evenly, and press well into cracks and holes. A good putty-up is equal to one coat of paint.

With paints made from inert materials, as barytes, silica, etc., it is sure that the greater the number of coats applied the more durable will be the painting, provided that sufficient time be allowed for each coat to harden.

It is said that window glass rosin dissolved in pale rosin oil makes a good substitute for Canada balsam.

Fatty paint, cut with turpentine, has its uses, but it is wrong to use it on good work, for fatty paint does not cover well nor last well, especially where the sun hits it hard; it is apt to blister and scale.

If there are greasy spots on the work you are to paint, apply a size of saltpeter in solution, or a very thin lime wash, or lime water. The same is also good for smoky walls or ceilings that are to be painted.

Even old painters sometimes must be reminded that paint in the pot should be stirred now and then while using. The oil will come to the top if not stirred, while the heavier pigment goes to the bottom.

I want to repeat that if the paint crawls, on account of the cold, or a too glossy surface, first size the work with benzine, brushing it on as you would a coat of paint; and as soon as it dries the paint may be applied, and it will stay.

To clean paint, wash it with a cloth dipped in thick suds of white soap and wipe off with a clean cloth wrung from warm water. Never scrub it with sand soap, as the grinding process, however light, will wear away any paint.

Mildew on paint is sometimes caused by the too liberal use of driers, and fatty paint also will cause it, for a paint that will dry soft is most apt to have mildew, under certain temperature conditions.

Oil Color On Aluminum Paint.—A writer states that he has learned that aluminum paint will

take oil color and make quite an improvement on the clear aluminum in some cases. "It may not be news to some, but I tried this without ever having heard of anybody else doing it."

NON-POISONOUS PAINT FOR TOYS.—Take white, pulverized chalk, 6 parts, and calcined magnesia, 3 parts, add a few drops of indigo water, and prepare with glue water to desired paint consistency.

FIREPROOFING COMPOUND FOR WOOD.—Mix together 1 measure of fine sand; 2 measures of sifted wood ashes and 3 measures of lime in powder. Grind up the mixture in linseed oil; give two coats, first a thin and then a thicker one.

WATERPROOF PAINT.—A waterproof paint may be made by dissolving two quarts of water, one pound of brown soap, adding six quarts of boiled oil and one ounce of vitriol. After removing the mass from the fire add two quarts of turpentine, and color with whatever you wish to mix with it. Strain well before using, and thin with turpentine to suitable consistency.

TO DO A JOB OF FLAT WHITE.—Thin with substitute turpentine (petroleum spirits) and add a little rubbing varnish as a drier. This will flat almost any paint.—*George W. Whigelt.*

TO CLEAN MARBLE.—For whitening boards or cleaning marble, take a half pound each of soda, powdered chalk and pumice stone, stir together in a small quantity of water and then add half a pound of soft soap. Mix it as a paste and apply with a scrubbing brush.

AN OLD IVORY EFFECT.—Apply two coats of white shellac to the work, and when dry scumble with raw umber, rubbing it off partially so as to leave a mottled effect. This will give the desired result.

SIZE FOR ALUMINUM.—"I see that some one advises white lead coat under aluminum, but this does not meet with my approval, because I have found that aluminum and lead have no affinity for each other, but fight shortly after being placed together. I once used lead on account of its whiteness, but when I found a bad effect I quit its use. The size that I use with satisfaction is made as follows: A good, quick-drying varnish, 3/5 parts; chrome yellow in oil. 1/5 part; turpentine, 1/5 part. Mix. This will produce a good, lasting job. It should be ready for this bronze in an hour at most, and in warm weather it will be ready for use in less time."—*J. P. F.*, Bozeman, Mont.

HOW TO REMOVE PAINT FROM TILES.—There is nothing more unsightly than spots and splashes of paint left on the floors and tiles of buildings. Most tiles will allow a wash of caustic soda being put over them, which will remove the paint without the necessity of using an after wash of acid to destroy the effects of the potash, water only being required, says *Modern Building*. But if the tile is likely to stain with the potash, a wash of diluted ammonia will remove the paint spots, which in turn can be washed off with clean water.

A DARK DINING ROOM.—A very good plan would be to paint the room in white enamel, or in old ivory or a little off the white. You will find this to brighten

the room considerably. Then if you do the ceiling in white or cream, with a plain white frieze, this also will help make the room lighter, by diffusion of the light from the two windows. The walls may be done with paper having a bright green or red stripe, for contrast. Ingrain is preferable.

Killing Knots.—Where there are not too many knots requiring treatment we would suggest that you take a rather heavy piece of iron (flat iron, for instance) place it over the knot and direct the flame from a blow torch upon it. After the iron has been hot for a few seconds, remove it and scratch off the pitch that has been drawn out. Repeat this operation two or three times until you feel that the pitch has about all been removed; then apply your shellac. After this build up the bare spot with a coat or two of lead and finish as desired.

Coloring in the Pot.—When you want to color or tint a pot of paint do not add the color direct from the can, but first thin it up a little with turpentine, or benzine, which is just as good for the purpose, and much cheaper. It is also a clever idea to thin up some color and place it in a bottle or other suitable vessel, and have it on the job, ready to add to the paint if needed. Another way to add color to paint, when mixing a batch, is to add color to the stiff lead, direct from the color can, then work this up into the paste. A good way, also, for adding driers.

Water Content of Paint.—Ordinary raw linseed oil carries usually from 0.50 to 1.50 per cent. or more of water. White pigments also carry more or less water, hence it is customary to allow a maxi-

mum of 2 per cent. of water as a natural content of paint. Any amount over 3 per cent. may be regarded as pure adulteration, according to Scott. To test the presence of free water in paint, white paste or mixed, add a very little eosine (aniline pink) to the mixture, and rub it upon a piece of porcelain or glass, then add a drop of water; as eosine red is unaffected by oil, turpentine or benzine, while easily dissolved in water, if any moisture be present it will at once show itself by the white paste turning pink. Some painters claim that water in paint, sometimes added to produce a flat effect, will do no harm, as it evaporates and leaves the paint unchanged.

Sizing Walls.—The question, "What kind of a size to use?" is certainly a very deep one. What is good in some places or for some walls is not good for others. We sometimes use too much sizing. Suction in walls is necessary for a good and lasting job. It is a practice in a good many parts of the country to put a coat of glue on the raw wall before painting. Nothing could be worse. Glue prevents the linseed oil from soaking into the wall and taking root or anchoring in the wall. The wall should be fed with linseed oil until it is absorbed sufficiently; until it stands out from the wall

Imitating Red Slate.—"I have a job to do where there is some red slate marble to do by imitating or graining, and I would be glad to get some idea of the colors needed, the ground to make, and how to get the effect." The ground may be made with three parts white lead and two parts Indian red; mix with raw oil and turpentine, half and half. Add driers sufficient. The graining or marbling is done with Indian

red and white lead. Underglaze with Indian red, make a pebbled effect, and vein in with a mixture of Indian red and white. When dry, varnish the work.

Painting Over Varnished Tile Paper.—"I wish to ask a question regarding painting over varnished tiling, whether it will be all right? The old paper is tight and good; will it be necessary to take it off? No; if the paper is tight you can paint over it. We would suggest first washing it off with water made somewhat sharp with sal soda, to roughen the surface and make the paper clean before painting.

Trouble With Dark Shade of Blue Paint.—Some blues of the rich dark shade are made up with a proportion of black in their composition, and this black, being very light, has a tendency to float to the surface when the blue is being applied, and to cause streaks, which considerably mar the appearance of the finished surface. To obviate this a simple plan is to add a very little bluish-gray paint to the blue when it is to be used as a body color. The gray may be made with a little lead and black, and some of the blue be added to give it a requisite tone. It must, however, be sparingly used, or naturally it will change the hue of the whole color.

Cleanser for Old Painted Work.—To make a smaller quantity than the following formula calls for, reduce the proportions. As it costs only about five cents a gallon, one may make a large quantity of it, and it will keep indefinitely. In five gallons of boiling water dissolve 4 lbs. of sal soda, 1 lb. of carbonate of potash, and $\frac{1}{4}$ oz. of bichromate of potash, all of which may be had of any large dealer in drugs and

chemicals. Now, add 3 gals. more of hot water, when the mass will be like a jelly. Apply with a brush, and clean up with a sponge. If the first attempt fails to make clean, try again.

PAINT FOR LEATHER.—What kind of paint should be used on leather, sheepskin, etc., and how should it be mixed? Use artists' tube colors, thinning to a paste with equal parts of japan drier and a good elastic varnish, then reducing to a working consistency with turpentine. Or you can use japan colors, thinned with twice as much turpentine as varnish, mixed as a thinning fluid.

EFFLORESCENCE.—Moisture acting on the lime and other mineral matter in the mortar and bricks, causes these to come to the outer surface of the wall, and being there dried by the air, a powder results, which is called efflorescence. Some chemist has analyzed this substance with the following results:

Soda	41.12
Potash	0.84
Magnesia	Traces
Lime	1.02
Chlorine	Traces
Carbonic acid	Traces
Sulphuric acid	51.93
Insoluble	4.88
Total	99.79

SHEARINESS.—Sheariness in paint is connected generally with inside work, where flat paint or paint having a fair proportion of turps is used. It results from the fact that the turps tends to make paint dry flat,

and oil to make it glossy. If a half-and-half paint is spread on a surface unequally, it will usually dry sheary. In drying, the turps evaporates and leaves an unequal film of oil. Where it is brushed out sparingly it will dry flat, and full, glossy. This is accentuated where the ground is absorbent, as on repainted inside work finished in one coat over a surface which has been limed and rubbed down with lump pumice. In flatting the work has a tendency to look sheary when worked on too much and where "overlapping" occurs. In repainting, two-coat work is not so apt to look sheary. Briefly, the cause is due to unequal mixing of the paint, unequal spreading, or faulty nature of the ground, and working too much with flat color. —*Australian Decorator.*

Acid-proof Paint for Wood.—Two masses are prepared, the one consisting of 30 parts by weight of sodium silicate (38° B.) and 40 parts of powdered asbestos, the other of 50 parts of the silicate and 60 parts of the finest talc, each of them being kneaded thoroughly until homogeneous throughout. The wooden vessel to be coated is made perfectly dry and a layer of the asbestos preparation about 1/12th of an inch thick is applied. When this is dry, which takes about eight to twelve hours at the ordinary temperature, but in four to six hours if moderate heat is applied, the second coating of the talc preparation is laid on, the thickness being the same as before. These successive coatings are repeated until the mass has attained a thickness commensurate with the dimensions of the vessel, which is finally dried at about 80° F., for eighteen to twenty-four hours. The acid-proof coating, which may be applied both outside and inside, will then be found to adhere firmly to the wood.

Paint for Golf Balls.—One part of dry pulverized white shellac, two parts of methylated spirit (alcohol), and one part of lithopone, all by weight. Mix the shellac and lithopone together, dry, place it in a suitable vessel, one that can be tightly stoppered, and add the alcohol. Shake occasionally until the shellac is dissolved.

Making White Lead Paint Dry Flat.—It is held by many expert painters that the addition of a little water to white lead will cause paint made from it to dry flat on walls or ceiling. First, beat up the white lead in the keg, then gradually add the clear water, constantly stirring, finally causing the water to unite mechanically with the lead. Then you can add driers and coloring as desired, reducing to a working consistency with turpentine. The water does no harm, as it finally dries out.

Glazing Walls for Tiffany Effect.—No matter what color the finish is to be, make the ground a buff color, using white lead tinted with chrome yellow. You may apply a very thin coat of white shellac over this buff ground, though it is not really essential. Having the ground good and solid and smooth, apply the glaze color, which must be a pigment that will glaze, such as Prussian blue, sienna, umber, etc. Glaze the surface with one of the glaze colors, and then have ready small pots containing various glaze colors, and a brush for each. These colors are dappled on, making a mottled effect. To get a uniform surface, stipple after mottling, and when this is dry, apply a thin coat of pale copal varnish, for the mottling will not be uniformly flat or lustrous, but mottled, so that the shellac is necessary here to make it uniformly soft and semi-flat.

What Is Venice Turpentine?—The real article is found in Italy, in the largest of the larch trees, in the form of a liquid resin, in the large cavities of the trunk, in the solid wood, five or six inches from the heart of the tree. Holes are bored with augers, and in these holes are placed wooden tubes, through which the resin flows into little buckets. The resin is collected only from May to October. It comes from the trees perfectly clear and needs only straining through hair cloth to remove bits of bark, etc. It was formerly imported only from Venice, hence its name. It is used in medicine, as well as in paste, etc.

Paint for Rough Work.—Take oxide of iron paint and Paris white in the proportion of twice as much of the former as of the latter, mix to a paste with linseed oil, and thin out with benzine and rosin oil, adding a cheap drier. A better grade can be made by omitting the cheap thinners and using only linseed oil. Or, you can use yellow ochre and Venetian red in same proportions as in the first case. Cheap white lead and Paris white, colored with cheap carbon black; and ochre, Paris white, lampblack and blue, and olive green, are similar formulas.

The following is a recipe for making black paint: Mix 18 lbs. of boiled oil, 25 lbs. of naphtha black, 18 pounds of raw linseed oil, 112 lbs. barytes, and 56 lbs. of white lead.

Making Disinfectant Paint.—The addition of carbolic acid makes a disinfectant paint, but it will color any light paint. Boric or salicylic acid also is used. One composition is made from red lead, feldspar, shellac, linseed oil, carbolic acid and turpentine. Any darker color may be added if desired.

Here is a formula for a white paint, to which a disinfectant may be added: Dry white lead, 20 lbs.; best zinc white, 300 lbs.; raw linseed oil, 4½ gals.; white japan, 3 gals. This paint, may, of course, be colored in the usual way.

A Water-oil Paint.—Where whitewash is not desired, the following may fill the bill: Mix together 40 lbs. of bolted whiting, 10 lbs. of dry zinc oxide, 10 lbs. of white lead in oil, 8 lbs. of raw linseed oil, 6 lbs. of potash soap, and 26 lbs. of soft water. The addition of a quart of copal varnish may be considered desirable. This will give about 100 lbs, of paint. ready for the brush.

Cleaning Paint Pots.—An oil barrel sawed in two will make a good lye barrel for soaking dirty paint pots in. At least once a week clean up all dirty pots, cups and cans, having dropped them in from day to day. Saturday may be a convenient time, and thus have clean pots for Monday morning. Or any spare time through the week. Or, boiling in water with sal soda, say, a pound to the bucket of water, will make the dirtiest pot bright and clean in a little while. The water may be saved for use again. It may be strained and kept in a tub for pickling pots and cups in. A painter writes to tell us how he does. He takes the varnish or paint cup or pot to the sink, and washes it off with water and soap, using a scrub brush while the paint or varnish is still fresh. If he cannot do this at once, he places the vessels in water, which will prevent drying until he has time for washing off at the sink. This would not do for old paint pots, however, being better adapted for the carriage paint shop.

In the half of a coal oil barrel place five pounds of fresh quicklime, two pounds of concentrated lye, and water enough to slake the lime. Then add water to make 15 gallons. Place the pots in until under the liquid, and allow to remmain until all the paint is soft, when they may be lifted out, pouring the contents back into the barrel, but keeping back the solid contents, which may be put into a suitable vessel, either for future use, or for throwing away. Stir the liquid now and then. You will need to add more lye from time to time, as the liquor weakens, and the pots may be washed off and allowed to dry, when they may be further cleaned by scraping and wiping. The dregs from the pots may be used for rough work, adding oil, etc.

To Make Wax Flat Varnish.—Heat a gallon of the best hard oil finish; also heat six ounces of the best beeswax; heat in separate vessels, and then add together. This should be done with care. Stir in the wax slowly. Now add by careful stirring two ounces of linseed oil, as a binder and to help when applying the varnish, that no laps or brush marks may be made. It makes the varnish more easy flowing and spreading under the brush. Some one advises the use of sweet oil in place of linseed oil, saying that the linseed oil and wax are prone to separate, but that sweet oil will bind the two together. But we apprehend that sweet oil, being a very poor drier, if a drier at all, would make the stuff too soft, even sticky. However, here is where you can test the matter for yourself. The oil and three pints of turpentine are to be mixed together, while the stuff is hot. This will make nearly two gallons of flat varnish. Strain it through a fine mesh strainer into a clean can. Use only perfectly

clean cans. Your brushes for applying this varnish must also be perfectly clean. Finish a panel or other certain part of your work at one stretch, for laps easily show, and are to be avoided. On outside work use a good, elastic varnish. To insure a good job, do your work carefully. This is true of all work, of course, but it is imperative with flatted varnish work.

Oil Paint Drying Flat.—Paint drying flat is frequently, but not necessarily, an indication of adulterated oil. The best of pure linseed oil will dry flat where it is applied over a very dry and porous surface. Oil is used in paint as a binder—to hold the pigment together and make it adhere to the wood. A certain proportion of oil is necessary to accomplish this purpose. Wood will absorb a certain amount of oil, also. Now, where paint is mixed with only an average proportion of oil, and is applied to a very dry, porous surface, the wood takes up its requirement of oil, and leaves the paint without enough properly to bind it.

Should the paint dry flat in spots only, an excellent practice is to go over the job after the priming coat has been applied, and touch up all the flat, dry spots with an extra coat of oil. This not only prevents premature flatting or wearing out of the paint in spots, but gives a much more uniform and satisfactory job.

When linseed oil is adulterated with mineral oils, flatting may be expected. The effect is much the same as if too much turpentine were used.

Glue Varnish.—Take white glue or gelatine for a clear varnish, and dissolve a pound in one quart of water. Just before using the varnish add to the solution $1\frac{1}{2}$ ounces of bichromate of potassium, which will make the glue hard and to a large extent make it

waterproof. If you let this mixture stand any length of time it will gelatinize and become unfit for use. Dark glue will make a dark varnish.

VERNIS MARTIN FINISH.—This is done on metal and wood. The surface should be made perfectly smooth, filling with paste filler on wood, hard or soft. Vernis martin is always done on soft or close-grained wood. After making smooth, apply a coat of good gold bronze, mixed with banana liquid; use a soft hair brush, 1½ or 2½ inches wide, double thick. Apply four coats, always the same way, allowing first and second coat to dry in a warm room. Rub down each coat, carefully, with curled hair, and be careful not to rub through the coatings. Apply each coat quickly, making long strokes, otherwise you may rub up the under coating. To finish, apply one to two coats of good varnish, which should be rubbed or polished. If pictures are to be added we calcimine or paint by hand before varnishing. The varnish should be made with benzol, otherwise the bronze will tarnish; but if not convenient to get benzol, give the bronze a coat of spirit lacquer before varnishing. The foregoing is the method employed by the furniture people.

According to some, the name is from that of its inventor, a Frenchman, Vernis Martin, while others say it is simply, in English, Martin's varnish. At any rate, this method seems to be simply glazing and varnishing over a prepared surface. Makers of furniture use it, and get the golden effect by three coats, first, the priming coat, which is thoroughly baked and hardened, with a second coat, which is of the best quality of varnish. The color is transparent, a rich golden tint, closely resembling the high-

grade all-brass beds. All this may be imitated with paint, glaze, bronze and varnish.

PAINTING THE OLD WINDOW SHADE OR STORE BLIND.—Take some rather dry or stiff old keg lead and thin it with turpentine, making a stiff paste, then add some color, such as may be desired, then thin with turpentine, quite thin. Now, with the curtain stretched on a frame, and made clean, apply the paint with a broad-bristle brush, getting the paint on thin. One coat may be sufficient, but if it should not cover well then apply a second coat, which will surely make a solid job. One coat is best if it can be made to cover perfectly. The old store shade may be relettered after the painting by following the old lettering, which will show plainly through the new paint. Gilding also may be done, sizing with oil size. In this way an otherwise good store shade may be made to last two or three lives, before being replaced by a new one.

VARNISHING OVER CALCIMINE.—"I have to varnish over some calcimined work. How shall I prepare the surface for it?" You may need to varnish it first, with light gelatine size; but most of the water paints on the market will not need sizeing, but may be varnished over the same as any painted surface. If yours is a hand-mixed calcimine, that is, a home-made one, and has not much glue or other binder in it, you may have to size it.

THE PAINT WOULD NOT GET GLOSSY.—It is a fact that should be generally known that a gloss upon a gloss produces a semi-flat. In order to get the best effect with a paint that is to dry glossy you must

have the coat that is next the last coat made somewhat flat, using turpentine. Then make the last coat a full-bodied oil paint. On the contrary, to produce the best dead effect you must put the dead flat coat on top of a gloss coat, or semi-gloss coat. The cause of a gloss producing a flat is found in the fact that there is a chemical action set up by the oil that sweats out the paint, killing the gloss.

PAINT EMULSIFIER.—Cheap, ready-mixed paint is often made with an emulsion liquid which usually acts badly on the colors employed. A German paint maker has hit upon an emulsion that he says will not act deleteriously on chemical colors in ordinary use: Dissolve three quarts of silicate in six parts of water. Remember that it is not the silicate of soda that is indicated. The older the silicate the better for the purpose. Mix this solution to thorough saponification with twelve parts of raw linseed oil. The greater the proportion of silicate the stronger the solution. Then dissolve three parts of lead acetate in nine parts of water and incorporate thoroughly with the oil solution. The proportion of lead solution must not be exceeded. The mixture is then used as an emulsified oil in the making of liquid paint.

CLEARING SHELLAC VARNISH.—"I have some white shellac varnish that has become somewhat dirty from use or dipping brushes into it, and want to know if it can be cleared so as to be used." If you will add a few crystals of oxalic acid, stirring it to make the acid mix, then allow it to settle for a few hours, the liquid will clarify, the foreign matters will deposit at the bottom, and the clear shellac may then be poured off into a clean vessel, one not made of

metal, as that will darken the shellac. Be careful not to add too much acid, putting in only a few crystals at a time, until the effects are seen.

Mixing Lampblack and Red Lead.—"In for- one so light, the other so heavy. Is there a correct mulas given for mixing red lead and lampblack tried. I find it difficult to mix the black with the lead, the way of doing this that I have not got on to?" There should be no difficulty about mixing red lead and lampblack together, as you state. Both being in the dry state, the lampblack should be placed in the mixing tub first, then add the oil, following with the red lead, which should be stirred in gradually, stirring constantly. Where large quantities are used it is best to take an empty barrel and fill it about one-fourth full with dry red lead and dry lampblack in the proper proportions, and head the barrel up. Then shake and roll the barrel for a few minutes, which will properly mix the two pigments and can be held in stock for use.

Painting Picket Fences.—Method, with a careful economy of time, is the best way with painting fences, as with everything else. There is perhaps no other piece of plain work over which one could waste so much time and yet keep at his work all the while; dawdling is the term to describe it; going back over the work already done, and then over again to see what has not been done, until the slower worker with a method has outclassed you in the amount done. Take a panel at a time, dust all the footings and remove obstructions, paint the right side edges of the whole panel first, then return, painting the left sides, finishing the rail between and lay off the fronts last.

After finishing four or five panels go to the back and lay off the back of the palings, or better, have a boy to do the back, instructing him well not to let there be runs and fat edges showing in front.

To Color Electric Light Globes.—First, mix the white of one egg, beaten to a frosting, and one pint of soft water. Strain through a very fine sieve, and make sure that no bubbles remain on the surface of the liquid. The bulbs should be carefully cleaned and polished, and then dipped into the mixture and hung up on a string to dry. After half an hour they should be dipped the second time to insure a perfect coating. When perfectly dry they are ready to be colored. For this, dissolve ten to thirty grains, according to the density of color desired, of any powdered aniline dye in four ounces of collodion. Dip the globes in this and hang up to dry. If not dark enough after about six hours, when they are dry, dip again.

In commenting on the above, *The American Druggist* says: "We cannot vouch for its worth. There is always danger to be apprehended from the use of collodion on articles exposed to any degree of heat."

A Paint for Wood or Stone That Resists Moisture.—Melt 12 ounces of resin; mix with it thoroughly six gallons of fish oil and one pound of melted sulphur; mix some ochre, or any other coloring substance with a little linseed oil, enough to give it the right color and thickness; apply several coats of the hot composition with a brush. The first coat should be very thin.

To Prevent Knots from Showing Through.—Shellac varnish is the most common knotting used.

but is not always effective. Years ago red lead mixed with glue size was used satisfactorily. For very particular work, aluminum, gold or silver leaf may be used, and is effective though more or less costly, and takes more time. The leaf must be applied on a size, gold size answering, and should cover a space slightly larger than the knot. As the size and leaf will cause a slight elevation of the surface, it would be well to rub down that part with sandpaper before laying the size and leaf.

Here is a formula that is well recommended: Mix one-quarter pint of japanner's gold size, one teaspoonful of dry red lead, one pint of benzine, and seven ounces of orange shellac; keep in a warm place until all of the shellac is dissolved; shake it frequently also. White or red lead mixed with gold size and applied warm is another form of stopping this defect.

The reason for knotting is not always well understood. It is necessary, because knots are end grain, lying at an angle to the main surface of the boards. They may cause trouble in several ways. The most important are—first, the great amount of suction; secondly, exudation of sap; thirdly, discoloration of the paint on account of sap of a pitchy nature present in all soft woods. Knotting stops suction and prevents discoloration. It cannot, however, always prevent the exudation of gum, as nothing will do this completely, but it may mitigate the trouble after heat has been applied to the affected part in order to draw out the gum.

Tinting Lead.—It sometimes occurs that you have occasion to deepen the tone of a color a little, on the job, and have none of the proper color with you. It is a good idea to take along to a job some of each

color used in the tinting, thinned a little with turpentine, in a bottle or other closed vessel, and then if needed it can easily be incorporated with the paint, besides which it will not get fatty as an oil paste color will.

Cleaning Dirty Brick and Stone Work.—Soot and grime may be removed with strong caustic soda water, using a fiber brush. Allow the lye to remain on 15 minutes, and then wash off with clear water. Stains may be removed by rubbing with a flat piece of sandstone, or a brick to which has been added a little oxalic acid. About 8 ounces of acid to the pail of water. Wash off well with clear water.

Painting on Leather.—Use japan colors, thin with turpentine, adding a little carriage finishing varnish. Oil color or paint will not do.

Red Lead in Priming Paint.—An English painter says that in England they never prime without adding some red lead to the paint, except where the color is to be dark. They add about a pound of red lead to 14 pounds white lead. This is thinned with 1/5 turpentine and 4/5 raw oil, with a little driers. He thinks this primer penetrates better than white lead alone, and holds coats of paint better. But too much red lead will work through and injure certain colors. He has burned off paint that was as much as 150 years old, and the knots, sized with red lead, were kept perfectly from staining the upper paint coats.

Putty for Yellow Pine.—When making putty for Georgia or pitch pine, make it a good bit darker

than a mere match for the wood, for in time the wood will become much darker and then your putty will appear quite light, and show every nail hole.

How to Thicken Mixed Paint With Soap.—Use a soap made from rosin and oil, finely shaved and melted in boiling water. Don't use a tallow soap, as it will retard the drying of the paint too much.

To Thin Coal Tar.—To thin up coal tar use coal tar naphtha, otherwise known as light oil. Solvent coal tar or 90 per cent. benzol is also a good thinner, but costs more than light oil. Heat coal tar before thinning with the liquid solvent.

Keeping Paint in Good Condition After Mixing.—After paint has been mixed for use and left to stand, a skin will soon cover it. Better pour water on to cover, and on this pour a little oil, if you wish the paint to stand for some time, and the oil will prevent evaporation of the water. This is better than removing skin.

Shellac on White Pine, Etc.—White pine or other wood that is to be painted and needs to be shellaced, should have the shellac on the bare wood, not on the priming coat.

After Burning Off.—If after you have burned off some woodwork and find the surface in bad condition, part spongy and part hard, better glaze over with rough stuff, made from whiting and white lead and japan liquid, something like carriage painters use. Make as smooth as you can, and when dry, say in 24 hours, sandpaper it down.

Quick Lead Paint.—To get a quick-drying white lead paint for any particular purpose, grind white lead in alcohol and thin with white shellac varnish. Flake white ground in pale japan and thinned with

Cleaning Coal Tar Brushes.—For cleaning brushes used in coal tar use the light oil mentioned, or benzol.

turpentine will dry hard within an hour in light coats.

Old Paint Skins.—If you have old paint skins and wish to use them as paint, boil them with some raw oil. Just enough heat to soften up the mass, and stir and add more oil as required. Heat is a great thing for softening old or hard paint or lead, and makes it easy to work up. After heating or gently boiling the skins, add a little benzol, enough to cut them more, and then some benzine will help, making the mass liquid enough to pass easily through a paint strainer. After standing until cold the paint will likely be heavier, and when wanted for use, as on rough work, thin up with benzine or oil, according to use it is for. In this way dollars can be saved.

Or the mass may be cut with sal soda and water, making an emulsion paint, one not as good as that produced by the first formula. Add at rate of a pound of sal soda to the gallon of water, covering the skins with this solution, and stirring, then let it stand a few days to do its work. Then pour off the water that is on the top, and thin up with oil or benzine, or both, as desired.

Never prime with fatty paint, nor with paint made from old skins, etc. Such paint, as well as boiled

oil, will not penetrate the wood, nor afford a proper surface for holding subsequent coats of paint.

Paint Streaking and Bleaching Out.—If the paint streaks under the brush it indicates poor mixing and want of straining. If the paint streaks after its application, and after drying, then it may be due to moisture, etc.

Thinning Thick Boiled Oil.—Boiled oil that has become too thick may be strained by gradually stirring in turpentine or deodorized benzine until it becomes sufficiently fluid. If this does not cause it to work freely, then add some raw oil.

Spotting and Bleaching of Paint.—An oil painted surface in time loses its gloss in spots, and the cause is the driers. Litharge and sugar of lead driers both tend to make the oil paint spotty. Oil that was not properly tank-settled is another cause.

Bleaching Dark Spots in Wood.—Knots and dark places in wood may be made lighter by use of chloride of lime, 17¼ oz., and soda crystals, 2 oz., dissolved in 10½ pints of water; after which, apply a solution of sulphurous (not sulphuric) acid. Pine knots cannot be bleached.

Adding Water to Mixed Paint.—In white lead and zinc paint, water may be added without the use of chemicals, by adding a very little at a time and stirring it in well. For other paints in which a larger percentage of water is to be incorporated, use this formula: 1 lb. sal soda, 1 lb. borax, each dissolved separately in 5 gals. boiling water; mix, then add

while stirring, 2 gals. raw linseed oil. Let stand three days then stir again and add a gallon of the mixture to every 10 gallons of mixed paint, if the paint is composed of lead and zinc. For paint composed of mineral or iron oxide brown, add only a gallon of mixture to 15 gallons mixed paint. More mixture than this in proportion will give a much poorer paint. Some ready-mixed paint makers use this formula because it holds up the paint better and does not allow the paint to become fatty. The ultimate effect is to make the paint coat porous, the water evaporating.

Why Paint and Oil Become Fatty.—This condition is due to the elimination of glycerine from the oil used as a binder to the pigment, which renders the paint compound fatty or greasy, unless the pigments are such as will absorb the oxygen, such as red lead and red oxide of iron.—*Standage.*

Preparing a Door for Graining.—This front door was badly blistered when I saw it. All old paint was burned off, the rosin in the wood was burned out, and then shellaced. Then the door was primed with red lead thinned with boiled oil, two parts, and turpentine, one part. When dry it was sandpapered and puttied with a mixture of dry white and red lead, equal parts, with a little whiting and japanner's gold size. When hard-dry this was sandpapered smooth and again painted with the white and red lead paint, after which coats the red lead was omitted, and the two coats of oak graining ground were applied. The first of these two coats was mixed with rather more boiled oil than turpentine, but the gold size was used in both. The door was then grained

and varnished, using good carriage varnish. At the end of two years there was no sign of blistering, or other fault.

In other similar cases white lead was used with very little or no oil, but was worked through with turpentine and gold size. In these cases the color should be used rather heavy, but rubbed out well, instead of thinning it out so much to float it on easy. It is this latter kind of paint and painting that causes much of the blistering of paint.

Cleaning Dirty Overalls.—Where clean overalls are required once a week, as in city shops, they are taken to the steam laundry and made white. But, where this cannot be done, and the work must be done at home, here is a formula for a cleanser recommended by a blacksmith for very dirty work: Take about equal parts of lump ammonia, borax, lye and oxalic acid. Dissolve in a gallon of water, and use about a gill or two to a boiler of water. As no proportions of the ingredients are given, it must be left to the judgment of the woman, who will know what ought to be used. This lye solution is used in connection with the family wash, boiling all dark and dirty clothes together, but we would advise not doing painty overalls with the family clothes. And any of the soap powders on the market will take the place of the formula given. Dark spots, caused by strong tinting color in paint, may be bleached out with Javelle water, which is made from potash and fresh lime, or use bleaching powder, or chloride of lime.

In the absence of other means, one may soak his dirty over-clothes in clear water, adding a pound of sal soda to the bucket of water, and letting the clothes soak as long as may be necessary to loosen

the paint. A day ought to be long enough, then take them out and lay on a board and scrub with scrubbing brush and soap. Follow this with a good rinsing in clear water. Or boil the clothes in a wash boiler, with some soda or washing powder.

Luminous Paint.—A luminous paint for signs and any work where luminosity is desired, may be prepared by mixing 10 lbs. white lead, ground in oil, one pint of pale rubbing varnish, one-half pint gold size japan, mixing to a thin paste, then add one-half pound of freshly calcined sulphate and add turpentine to make one-half gallon of paint.

Fireproof Paint for Scenery.—Used in fireproofing theatrical sceneries: Zinc white, 7 lbs.; air-slacked lime, 3 lbs.; raw linseed oil, 1 qt.; dry white silicate of potash, 33 deg., 1 quart; dry white lead, 5 lbs.; zinc sulphate, 1 lb.; water to form a paste. Mix the zinc, lime and sulphur together, then stir in the water-glass, and when this has combined, add the white lead and zinc sulphate, then thin with water to desired consistency. Mix only as required for immediate use.

Painting Creosoted Shingles.—If the shingles have been exposed for some years they may safely be painted over, though the very light paint might be stained by some remaining creosote.

Dipping Paint for Window Sash.—For cheap work, mix together 8 gals. gloss oil, or rosin and benzine mixture, 1 gal. raw linseed oil, and 1 gal. pale japan drier. Mix with this 25 lbs. bolted whiting, and strain. Thin with 2 gals. benzine.

Cleaning Enamel Paint.—To renovate an enameled paint surface first dust off and then cleanse with this: Have some precipitated chalk, though very fine whiting will do, though more liable to scratch, and with a damp rag rub over the work with a gentle rubbing. Dip the rag, soft flannel is the best, into hot water, and wring out dry, and dip into the whiting. After this wash off with clear water and rub dry with a soft dry chamois.

To Clean Dirty Painted Surface (walls particularly).—Cut into thin slices a pound of good, brown soap, and put into three quarts of hot water; add one ounce of borax powder; let simmer on stove, but not boil. Stir now and then. Rub on with old flannel, and as you clean off wash with clear water. This will remove all dirt, and make the paint like new, without injuring it in the least.

Cleansing Slate Blackboard. — To remove grease, oil or spots from a genuine slate blackboard, use paint and varnish remover, or benzol, or alcohol, and if these fail, try equal parts of banana oil, bisulphide of carbon and fusel oil, mixed and applied with a sponge to parts affected. Strong ammonia may also be tried.

How to Paint Window Blinds.—Never hold a window blind on its edge when painting it, inside of the rail, for it will cause the paint to run into the pinholes, making the slats work badly when the paint is hard-dry. When you have painted the blind, set it up on its top part, so that any of the paint that may run will not run to the bottom end, and form edges that will catch on the window sill. Always open out

the slats when done. Have a little stick for opening and closing the slats when painting them. Leave hand-holds on the sides of the shutters or blinds, for handling them until set up, then the hand-holds may be painted out. One may in this manner keep hands and tools clean. Nice, also, to have a rag to wipe the hands on.

Painting Burlap.—To paint over faded burlap fasten any loose parts and apply a varnish size, after which it may be painted in the usual manner of wall painting. Either a gloss or flat finish may be made, or the last coat of proper color, may be glazed with any desired transparent color, applied thin and rubbed out to give the desired scumbled effect.

If the burlap has mildewed, then brush off with a stiff brush and apply this size: Dissolve 4 oz. alum in 1 gal. hot water, 4 oz. bluestone in 1 pint of water, 2 oz. gelatine or fine white glue in 2 quarts of hot water, and 2 oz. sugar of lead in 1 quart of water. Mix separately and while hot, adding the bluestone solution last. Apply and allow it to dry. This is presumed to keep back any further mildew.

Oil Stained Tile.—Oil stain is difficult to remove from tile. Hydrochloric acid will not do it, and chloride of lime has only a temporary effect. Standage recommends this: Cover the part that is stained with soft soap, and after a few hours lay over it a piece of muslin, folded several times, first saturating the muslin with a strong solution of washing soda; then remove by scrubbing and washing, and wiping dry. Repeat if necessary. Or, try this: Two parts fullers' earth, one part each of soft soap and potash, all by weight. Mix with boiling water to

a paste, apply, and in two or three hours remove and wash off.

Cleaning Paint Pots.—Make a fire within the pot, with some paper or excelsior, and a few bits of wood, and set fire to it; in a minute or two begin to scrape down the sides, and then dump out the fire and finish scraping, inside and out. Or, in a tub place 5 lbs. lump lime and add water enough only to slake it; then add 2 llbs. concentrated lye and water to make 15 gals. Stir, and put in the pots. Over night they may become fit to clean off by scraping and clear water.

Glue Size on Old Work.—I painted a building, two sides of which was of new siding, the other sides old and rough. The new work got two coats of lead and oil, and the old work was glue-sized, with some whiting in the size, and then one coat of lead and oil. To-day, twenty years later, the old work is in better shape than the new. I made the glue size very thin, but there was enough whiting to make a paint of it. I applied the glue size coat with a whitewash brush. The old wood should be quite dry, and the glue size applied hot.

To Prevent Aniline Red from Bleeding Through.—Mr. Whigelt gives this formula: Copperas (sulphate of iron) 1 lb.; hot water, 1 gal.; dissolve. In another vessel mix together 1 lb. of alum and 1 gal. hot water. When both have been dissolved, mix together and apply freely. The copperas acts as a mordant, preventing aniline from bleeding through.

Aniline Stain Comes Through Shellac.—Shellac ordinarily holds back aniline water stain, but

if it is a spirit stain, then the alcohol in the shellac will act on the spirit aniline, and the latter will bleed through. Apply a coat of dark lead flat paint, after which moss down the varnish and apply whatever paint you desire for the finish.

Paint Crawling.—To prevent paint from crawling I take a piece of thick woolen goods or soft sole leather and tack on a block of wood. A few rubs on the surface to be painted with this tool will produce a warmth by friction that will fit the surface to take the paint as it should.—*Anon.*

Pine Tar in Priming.—An experiment was made in 1900 in which a square, 100 feet, of Georgia pine, was nailed up on a southern exposure and primed with a mixture of pine tar one part, boiled linseed oil 3 parts, without addition of pigment. When perfectly dry it was finished with two coats of white lead thinned with boiled oil. Examined after three summers, it was found in good condition, no checks, cracks or chalking. It had long been the opinion of the experimenter that clear oil priming on either wood or iron was better than a paint.

Gloss Varnish may be made my boiling a gallon of raw linseed oil for one hour, then adding two pounds of rosin, stirring the whole until perfectly amalgamated. Then add one-half pint of turpentine and an ounce of gum camphor; then strain.

Grain Paint.—This is intended for priming a rough old exterior surface. Boil two pounds of rye flour, and while boiling add two pounds of thinned old paint, stirring the mass until perfectly homogenous. Apply one or two coats.

To Clean Mouldy Wall.—Wash it off with a weak solution of hydrochloride of lime. Mildew may be removed with alcohol.

Compound Paint.—A compound paint may be made from 50 lbs. white lead, 25 lbs. dry zinc white, and 25 lbs. best whiting (Paris white). Mix the zinc and whiting together and run through a strainer, then mix up the lead and stir it into the other mixture.

Tacky Green Paint.—Of the different colors used on a certain job, the green alone failed to dry right, and on shaded or protected parts the green was very sticky. Both hand-mixed and ready-mixed greens acted this way. What was the trouble? The green may contain such non- or poor-drying pigments as drop black, ochre, barytes, clay or silica. Chrome yellow in this combination acts particularly bad. Prussian blue and chrome yellow would give a green much less liable to dry tacky. Likely the oil the green was ground in was spurious; still, the blacks and chrome yellow do badly even with pure linseed oil. Painters in seashore locations have this trouble with green, and also with Indian red and Tuscan red. They prevent the trouble by adding some spar varnish to the last coat, a pint to the gallon of paint. This gives a high gloss and hard surface, preventing the entrance of moisture, and the paint dries good enough.

Painting Over Bleeding Red.—To ascertain whether red is a bleeder or not, wet a rag with turpentine and apply it to the red, and if not a fast red, some of it will come off on the rag. If paint has been applied over a bleeding red, then the only thing to do

is to remove the red entirely. If this is not feasible then apply two coats of shellac, and a good washable water paint, two coats, has been known to do the trick. Some obstinate cases are on record where three or more coats of the washable paint were necessary, but such is unusual.

Paint Creeping.—After sizing a wall with thin paint, then sizing this with glue size, to stop suction, the glue size creeps. What is the reason? Due to plaster being harder in spots. After priming with paint and it is dry, note any glossy spots and sandpaper them out. Make the glue size weak and brush in well.

Running of Paint.—This is likely to occur in fall or winter, when the wood is cold, and more or less damp, on exterior work. As raw oil will not dry as fast as boiled oil, or raw oil containing driers, the paint mixed with it is more likely to run than otherwise. In two cases of the kind, addition of more drier cured the trouble.

White Lead Thinning After Mixing.—Pulp lead, that which has been ground in water and the water not all eliminated will cause this by forming an emulsion with lead and oil. But there is another cause of the same trouble, and that is, the excess of hydroxide in the lead.

Swedish Paint.—An emulsion of linseed oil, fish oil, or train oil, with a solution of soda or potash in water, to which any earthy pigment may be added to give covering power. The best grade is made after this factory formula: Grind 200 parts by weight of

zinc oxide, and 20 parts yellow ochre ground in boiled linseed oil to a soft paste, thin it with 120 parts by weight of whale oil, 20 parts turpentine, and three parts liquid drier. To the mass add soda or potash solution according to grade desired. A cheaper formula is this: Boil 1 lb. zinc sulphate in 2 gals. rainwater until dissolved. While hot, add 5 lbs. rye flour, which cook to a paste, and into this stir 3 lbs. whale oil into which has been melted over the fire 2 lbs. rosin, stirring until all is a homogenous mass. Earth colors may be added as desired. If too stout, thin up with hot water. This is intended for rough woodwork, as the first also is.

Borax Solotion.—To make borax solution with water, take 10 parts borax, 30 parts coarsely pulverized shellac, and 200 parts water; dissolve by steam bath for a few hours, and when cold filter; a few drops of glycerine will make it more pliable.

Soda-glue Solution.—This is sometimes used in making cheap, ready-mixed paints. Formula: water, 200 gals.; sal soda, 5 lbs.; borax, 1 lb.; glue, 2 lbs. Mixes with oil, turpentine, etc. paints.

Fireproof Paint.—There are many formulas. Here is a liquid for making one: To one gallon of a mixture of equal parts of lime water and vinegar, add 8 oz. table salt, and 4 oz. sulphate of zinc, each powdered. Boil this mixture, then add one gallon of boiled oil and repeat the boiling. Take from fire and stir in a gallon of crude petroleum, heat again, carefully now, on account of fire, bring to the boiling point, and it is done. Mix with any desired pigment to form a paint.

A Drying Oil for Zinc Paint.—To make boiled oil especially adapted for zinc paint, or indeed for any lead paint, mix one part binoxide of manganese in coarse powder, but not dusty, with ten parts of linseed oil. Keep it heated and frequently stirred for thirty hours, or until the oil begins to turn reddish.

Cheap Dark Pigment.—A cheap paint may be made from two parts Venetian red to one part Paris white or gilders' bolted whiting. Paris whiting is one grade finer than gilders'. Mix to a paste with raw oil, and thin out with one part benzine to three parts oil, and 1/7 as much of gloss oil. Mix a pound each of bicarbonate of soda and phosphate of soda in hot water and stir into the paint.

Another cheap paint: Mix together, dry, one part Venetian red and three parts ochre, adding white lead, in oil, to give body. Add about one part of lead. If the color is too bright, add some black. May be thinned with any cheap thinners as desired, and according to the character of the work.

To Make a Drying Oil.—To a half-gallon of water add a pound of lead acetate (sugar of lead). Shake often, and when the lead acetate is dissolved add two quarts of water, then filter it, and put into three gallons of raw linseed oil, stirring in a pound of powdered litharge. Shake often, and let stand several days. The oil found at top of this mixture is the "drying oil," and must be poured off into another vessel. It is clear and bright, and dries in about 24 hours.

Thinning Oil Paint With Water.—This is an old trick. Place a pound of gum shellac, the white

grade being better as to color, and one-half pound of sal soda in a vessel, which put on the stove and cover ingredients with water. Let it boil until contents are dissolved. When cool it may be put in bottles for use. Add to oil paint at the rate of one-half pint to the quart of paint. Stir it in, and after the paint has thickened up, add water enough to thin up to a working consistency.

Flat Oil-water Wall Paint.—May be made by taking fifty pounds of gilders' whiting and placing it in a tub, pour water on it until it is covered, and after standing, say all night, pour off any water that is on top and beat it up with two gallons of hard oil, or even with gloss oil, adding any color desired, using dry or distemper colors. Then thin it down with benzine or turpentine to a working consistency. Such a paint will dry flat and can be made very cheaply.

Emulsion Solution.—Here is another emulsion solution for making cheap paint, it being a formula once used by a ready-mixed paint maker:

Lime water	3	parts
Lead and zinc solution	1½	"
Silicate of soda solution	1½	"
Benzine	5	"
Raw linseed oil	3	"

The lead and zinc solution is made with two parts of sugar of lead (lead acetate) and four parts of zinc sulphate, dissolved in 16 parts of water. The silicate solution is made by dissolving one pound of silicate of soda in one gallon of warm water.

Milk Paint.—Into a gallon of whole milk stir about three pounds portland cement, and any dry

color you may choose. Sour milk, skim milk or buttermilk will also do, but the whole milk is best. Keep the paint stirred continually while using, as it settles quickly, and this is its worst feature. Once dry it is like cement, and will resist the weather for years. Good for barns, fences, stone walls, etc.

Oil Thickener.—Substitutes for linseed oil are most generally based upon mineral oil, which is very thin, lacking the body of pure linseed oil. To give such an oil body the following thickener may be used: Into 20 gals. hot water stir 110 lbs. oleic acid, adding gradually, in a stream, a soda lye made from 77 per cent. caustic soda dissolved in 10 gals. water. This gives oleate of sodium upon boiling. Practically it is a soft soap. It is to be poured into a solution of alum, 70 lbs. alum in 202 gals. hot water. This in turn produces aluminum oleate, which is skimmed off and dried and mixed with oil, at the rate of 50 lbs. to 200 gals. oil at a temperature of about 240° F., this heat being kept up until solution occurs. There you have a "thick oil" or "gelatine," for thickening or gelatinizing thin mineral oil. This thickener is like jelly, and is transparent, ranging in color from light straw to dark umber. It becomes very thick in cold weather. To mix with oil, heat the oil up to about 250° F., and measure or weigh out the thickener, and add it to the warm oil. It mixes easily and blends perfectly, so as not to be noticed.

Petrifying Liquid.—This is much in use in England for use in washable water paints. Here is the formula used by one British paint maker:

Wood alcohol	8 gals.
Resin	8 lbs.
Gum sandarach or shellac	28 lbs.

Agitate until the gum is dissolved and then add two gallons of turpentine. If for inside use, a wall, mix white lead, say 3 lbs., with a gallon of good, hard varnish, preferably spirit varnish, like shellac, then add two gallons of the petrifying liquid, and thin it if necessary. For an outside wall omit the varnish.

This "petrifying liquid" is much used for damp walls, both above and below ground. In place of wood alcohol use denatured alcohol. Some formulas call for no alcohol at all.

Lime Water for Paint.—To make a lime water for mixing with paints, slake ½ bushel of fresh quicklime in 40 gals. water, hot being best, and let it stand for 24 hours, then draw off the clear water for use. In a suitable vessel containing linseed oil slowly add the lime water, stirring in the pigment desired very gradually and thoroughly, until the mass becomes of suitable consistency.

Effect of Frost On Fresh Paint.—If the paint is affected it will show a spongy surface, and the paint will have lost all gloss. This injury occurs usually at night, the part painted in daytime and dry or nearly dry before night coming through all right. I have noticed that a wind or breeze will cause the trouble, and that when there is no stirring of the wind the paint usually escapes unhurt. The frosted surface is soft and rough, and there is no remedy, unless another coat on it may be called such. The extent of the damage done to the integrity of the paint is unknown to me. Its worst result seems to be its mean appearance. Would advise not painting in afternoon or after mid-afternoon on such parts as

are exposed to the direction of prevailing wind. It is not the cold that does the mischief, but the frosty night air.

Surface on Cracked Paint Without Burning Off.—Make a filler of whiting 1 lb., dry lead 2 oz., and glue 2 oz., the glue to be dissolved, of course. Apply with brush and use putty knife if necessary, though usually brushing it in will do. Let dry hard, rub down with sandpaper, apply three coats of paint, and a nice, smooth job results.

Remove Locks, Etc., Before Painting.—When a room is to be repainted it is well to remove the knobs, locks, sash fasteners, etc., first, and before replacing them soak in a little sal soda water and make them clean again.

Emulsion Paint Solution.—The following formula is said to give a good solution for making emulsion paint of good wearing qualities:

Concentrated lye (potash)	1 lb.
Dissolved in water	1 gal.
Fresh quicklime	2 lbs.
Slaked in water	4 gals.
Good glue	1 lb.
Dissolved in water	1 gal.
Zinc sulphate	2 lbs.
Dissolved in water	3 gals.
Whiting	100 lbs.

The four solutions are prepared in separate vessels. Add the lye to the limewater, pour in the glue solution, and finally add the zinc solution. Add water to make 20 gals., and stir in the whiting.

Flat-oil Turpentine Paint.—Use white lead or zinc, or both together, as desired, add any desired coloring or leave white—the usual way—and thin with turpentine. This is really only a dull, not a strictly flat paint, as in the latter case all oil must be omitted. This paint is washable also if a little hard-drying varnish is added.

Softening White Lead Hard in Keg.—Dig out the lead and place in a vessel that may be set on the back part of the stove, where a gentle heat will soften the lead. Add a small quantity of raw oil to the mass. When sufficiently heated through the lead can easily be mixed for use. Heat is a great softener of hard lead, zinc, putty, etc.

To Hasten Drying of Paint.—Without adding more driers, which tend to make the paint too soft. It is said that the addition of water glass (silicate of soda) at the rate of one-fourth of the bulk of the paint, will cause the paint to dry quickly. Being an alkali, its effect would be to emulsify the paint somewhat, hence, and having never tried it, we would say try it as an experiment first.

Preserving Zinc White In Oil from Hardening.—When the zinc can or other container is left to stand for some time, the top hardens, often to quite a depth, and this hard zinc is almost beyond mixing unless run through a mill. We heat it, and then can mix it. But, to prevent it, level the surface of the zinc and spread over it the oil that comes to the top, then lay a neatly-fitting sheet of paper over it and press it down tight, so that the air cannot get under it. Whenever you wish to get out any of the zinc,

raise and remove the sheet, and when done replace it again. We find some white lead makers use this plan, covering their containers wtih the paper, so that when it is opened the paper can be easily removed and replaced again, keeping the paste in good form.

Painting Oil Cloth.—To make oil cloth, first paint the cloth with a hot solution of soft soap, dry it, then size with hot alum solution, dry it, then paint with oil color made from fine pigments, plenty of good driers, oil and some turpentine. Finish with a thin coating of good copal varnish. Harden at a temperature of 200° F.

Glue Size on Interior Wall.—How should glue size be used under paint so that the paint will not peel off? First apply to the wall on the plaster a coat of flat wall paint; when this is dry apply a thin coat of glue and alum size. Finish with a coat of flat wall paint. The paint will not peel off.

Best Time for Exterior Painting.—An expert master painter tells us that "when Nature gets her ovens to going is the best time to paint." In other words, paint will dry better in July and August than at any other time of the year. In spring there is much wet or dampness, and paint does not dry well. Opinions as to the best time for painting differ largely; but nearly all the standard authorities concur in the opinion that a temperature of from 55° to 80° and an atmosphere that is as free from moisture as possible favor the best results.

Repairing Over Sanded Work.—If the sanded surface is in very good condition, it will be well to

paint and sand over it. If not in good condition then scrape off old sand. It cannot easily be burned off. Before scraping off saturate the old stuff with coal oil or benzol. If coal oil or heavy mineral is used, let it soak in for a few days.

PAINT FOR HORSE STABLE.—In the main the paint used for general house painting may be used on a stable, inside and out, only on account of fumes of ammonia from the manure, white lead cannot be used.

GRAINING OVER WHITE ENAMEL PAINT.—If you do not care to remove the enamel paint rub it with steel wool, to remove the varnish gloss, and to the coat of paint first applied add a little rubbing varnish, which will prevent all scaling. The gloss may also be removed with sal soda water, or with benzol. Either of these will cut the gloss, and that is the main thing to do in the case.

PAINTING TARRED PAPER ROOF.—Some roofing has had an asphaltum coating, the most inferior having coal tar. To paint over such roofing one may use oil paint, but asphaltum varnish will be better. Make the varnish thin with turpentine or benzine. Makers of the best asphaltum coated roofing claim that it will never require painting, and this is no doubt so.

IRON OXIDE PAINT LOSING ITS LUSTRE.—This often occurs with iron oxide paint when mixed with raw oil, and more particularly if a little tupentine has been added. The trouble may be avoided by thinning the paint with boiled oil, adding a little exterior varnish or japan gold size.

Painting on Stucco Decorations.—First brush down the work and make it clean. Then prime it with equal parts by weight of white lead, red lead, and boiled oil. Second coat with white lead paint and a little driers added; color if desired. The thinning mixture for this coat is made of two parts boiled oil and one part turpentine. Third coat the same, and if a fourth coat is used, use little or no turpentine with it.

Salt Affecting Paint.—A paint for a warehouse where salt was stored was desired, and one that would not be affected by the salt. Probably nothing is better than red lead, for this is used on the Italian ships which bring salt to Gloucester, Mass. These ships are of iron, or steel, and wherever rusting occurs from the salt may be seen daubs of red lead paint. Even the white exterior is seen daubed with red lead.

Painting Canvas for Roof or Floor.—Using, say, 8-ounce weight canvas, stretch it and tack with galvanized tacks. After coating the under side and allowing it to dry, wet the upper side with water and paint while the canvas is damp. This will seem strange, but it has been found that it makes the canvas more waterproof.

When Is Paint Dry?—Or how long should exterior paint stand before applying the next coat? In a general way we might say 24 hours, but it depends. One painter says he allows it ten days, or more, according to the weather. Our opinion is that 24 hours, under average conditions, is sufficient, and that if we allow the paint to become too dry it will not take and amalgamate with the succeeding coat well. An

authority says that the coats of paint when applied at such an interval as 24 hours or so will become one coating, the oil from the upper coats penetrating and mixing with the under coats, so forming a homogenous mass.

PAINTING OVER COAL TAR.—Where careless workmen have smeared coal tar, or where pipes have been coated with it, and it is desired to paint over same, scrape away all the tar possible and coat it over with very thin brown shellac.

PREPARED ROSIN.—This is a synthetic rosin, made by German chemists. There are common rosin, white rosin, water-white rosin, for shellac substitute, this being the highest priced.

INSOLUBLE WHITE SHELLAC GUM.—When shellac has been over treated with chlorine, it is very apt to be insoluble in alcohol, but if it is first moistened with 1/20 of its weight of ether and allowed to swell in a closed vessel, its solubility in alcohol is restored.

GRAY AND GREY.—Two ways of spelling the same word. Gray is the old Anglo-Saxon way. Grey is the modern way, and is used to specify greys, known as French grey, etc., in millinery, etc. Most dictionaries make no distinction between the two forms, but many writers on color use the word *gray* to indicate mixtures of black and white, to form gray, and shadows or grayness; and *grey* to indicate those greys in which purple tones are noticeable.

MIXING PAINT FOR FROSTY WEATHER.—A painter wished to know how white lead should be thinned

for use in frosty weather, so that on the finish it will not curtain or shrivel. The only difference in the mixing would be that some turpentine might be added to allow of easier spreading, being careful not to add enough to injure the gloss desired for the finish.

Varnish In Exterior Paint.—A little good spar varnish will make the paint somewhat harder, and hence add to its wearing quality, but as a general proposition it is not deemed well to add varnish to exterior oil paint; it does better with flat paint.

Painter's Cream.—This is a preparation used by artists for preserving an unfinished oil painting until they can resume work on it, or to prevent drying of work already done. It might be used on ornamental work in oil on ceilings. It can easily be removed. The only formula we know of is to mix and triturate one and one-half pounds bleached walnut or poppy-seed oil, preferably the former, one-quarter pound gum mastic, finely pulverized, and one ounce white sugar of lead that has been ground fine in oil, in paste form, as it is sold to artists in tubes. When this mixture has been well beaten up, forming a uniform mass, add water slowly until it is the consistency of thick cream.

Making Moving Picture Screen.—So far I have not seen any one able to apply bronze without showing streaks when the light is thrown on. The Radium Gold Fiber Screen is a bronze screen that sells for from $40 to $60. I and others have been trying to make a screen that would give the same effects for less money, and here is what we have, and it gives just as good a picture: Get the canvas in a

piece a little longer than you want your screen to be, and give it a weak glue size, then a thin coat of flat paint. If it is not to be handled much, get window shade cloth or linoleum, as these do not have to be prepared; some use the latter.

If you use canvas or window shade cloth, stretch it on a frame and lay it on the floor; build a scaffold on both sides of it, so you can have a plank or two to work on, about a foot above the frame. If you know how to make bronze size, all right; if not, get a good gold size that will come to a tack in about two hours. Now, take 2/3 lb. aluminum powder of best grade, and 1/3 lb. of gold striping bronze powder, mixing the two thoroughly together. Get a good sized pepper box, and, after the size is right, dust the bronze on; don't be afraid of getting too much on, for the size will take up only so much; then tilt the curtain one way, and then the other way, and be sure not to get your fingers on it until it is good and dry. Don't use a pounce, for that will cause streaks. In this way you will have just as good a job as one costing $50, a screen not to be surpassed outside of the Mirror Screen, which not many can afford.

The calcimined screens are not used much any more.

Paint Peeling.—A house painted about sixteen years, when repainted, after previously having been painted at least twice without any defection, peeled off in scales, on all sides, and all over, and was not due to moisture. Best oil used with lead. The paint skins were examined by a chemist and found to be not pure white lead, though it could not be said which coat contained this dope lead. The last coat of paint

was applied two years before scaling. The fact that the paint scaled clear to the wood indicates that the trouble was due to the priming coat. The scales were very heavy, and the paint was too thick to hold well. The priming coat was of some hard material, probably barytes or other inert, hard pigment, usually added to dope leads, and the subsequent coats could not penetrate this, failing which there was no bond of union with the wood. When the primer is of pure raw oil and white lead, subsequent coats of the same material will cement and form a close bond with the wood.

Blistering, Cracking and Scaling of Paint.—Dampness, unsuitable materials, unfavorable conditions for the work, paint not adapted to the work, yellow ochre priming, cheap ochre in oil or dry, white or gray ochre priming, fat paint on priming, ochre soaked in oil for a long time before using for priming, or for coloring lead, colors made of ochre, green, red or black, in oil, and hardly any white lead, and no tupentine, undry priming coat when second coat is put on, poor priming coat, not enough raw oil, coal oil and benzine thinners, cheap ready-mixed paint, sappy wood, these are some of the main causes.

Blistering never used to occur when we used pure raw oil and white lead paint, and gave each coat time to dry in. Nor did it ever crack, scale or powder off.

"I have noticed on many old houses where sash have always been painted black, never leaded with a first coat, front doors or outside doors and blinds always painted green, dark brown or red, that they never crack, but have a smallpox appearance; and on the house proper, where lead, oil and turps have been used, there is an absence of either blisters, cracking

or scaling. Now, as to cracking, if we should prime a building with a fat material composed of ochre, red, green or black, and apply one or more coats of zinc and lead, or apply the same number of coats of mixed paints, that in some mixed paints in the light shades, you will have one of the best alligatored jobs, more so than if lead and oil had been used. The cause is, the mixture, whether lead, zinc or oil or mixed paint, is altogether too inelastic and brittle for the under coat.

"Scaling is also caused by dampness and sappy wood on certain parts of a building, but that is of rare occurrence, as compared with the many blistered and cracked jobs with which we come in contact in large cities.

"When a cheap primer is used or a paint composed of dark colors or other than lead and oil, it will blister where shaded, such as under porch roofs, but not on exposed surfaces, where it will crack and curl up. On porch columns, one-fourth or one-fifth of the column will show blisters because the undercoat was not hard. The sun shining on it will boil the moisture underneath, and it will expand, and result in a blister. If you had used mixed paint or paint with zinc in it, the outside will dry hard and crack. Your old material and extremely dark colors used for priming or painting a house will always cause blistering. Most painters will recommend dark colors because they are cheaper to put on than lead, the work not requiring so much care. That paint does not get as hard as lead. A man will trim the house with two coats of color, just alike, and the result is a mass of blisters. It is the painting done ten, fifteen or twenty years ago that is causing the trouble. How many painters use lead on outside blinds or front

doors? The main part of the house, painted white, does not crack, peel or blister. The dark colors are a mass of blisters."—*Correspondent.*

Raw and Boiled Oil In Paint Blistering.—Will blistering be more likely to result from the use of boiled oil than raw? It is generally thought and believed that boiled oil causes blistering of paint, but the trouble may be due to not thinning the paint properly. A master painter, speaking on the subject, says:

"The coats may have been too thick, or too little turpentine was placed in the priming coat to secure proper penetration. Boiled oil should not be used in the priming coat, I think, but if so used then add plenty of turpentine, making the paint thinner and brushing out the paint well, nice and smooth. The painter, as a rule, puts on too heavy a coat of paint, and does not brush it out well. Probably one-third more paint than is necessary is used on a house outside. Where a man rubs his brush out in the shop you never see any blistering. Have you ever noticed this fact? If not, then look at the place where the men rub their brushes out, after taking them from water or paint. Some will object to rubbing out on the priming, many flow it on and allow the wood to take up all it can; but there is a limit, even here. The wood may leave too much unabsorbed on the surface. But boiled oil will not penetrate well unless thinned with the turpentine. You will, of course, use less with raw oil."—*Anon.*

Paint Scaling from Iron Work.—"The first thing we are asked to do in a new structure is to prime frames and iron work. If so specified, the iron

work sometimes comes first, coated with red lead or graphite. When it comes coated with graphite it is generally tar mixture, and when coated with red lead the iron is so rough it cannot peel or dust off when not exposed to the weather. Some factories use most any kind of dope, and when you find the red lead dope on galvanized iron frames and the building not more than half completed and the red scaling off, or by friction of the hand, you can readily see what kind of oil it contains. (This is the fast drying kind.) Then the painter has to put his finish over this dope, which may last about as long as a paint will on the doped "iron fences." Then the painter is up against it, and is due to make necessary explanations of scaling, etc."—*A. Smith.*

Time Between Coats.—How long should the first coat be allowed to dry and harden before applying the next coat? I make it a rule in my business to let it stand ten days or more, according to the weather. It is not so much a matter of applying a heavy coating of pigment to make a good job of painting as to make it even and uniform. This can't be done on a soft surface.—*Correspondent.*

Adding Whiting to Red Lead.—Red lead can stand the addition of whiting without injury. The weakness of whiting as a color does not affect it much, if at all, in the matter of color. Adding whiting to red lead has an advantage. It serves the same end as adding water, viz., it keeps the lead suspended and prevents its settlement, which is such a feature in red lead. The addition of a small proportion of whiting should in no way affect the durability of the coat of red lead. Red lead is used largely for paint-

ing iron structures and machinery. Owing to its heavy nature and the non-absorbent character of iron, it is very apt to run. The addition of whiting checks this tendency.

To Restore Gloss to Frosted Paint.—In winter no exposed painting should be done after noon, or the frost may take off the gloss. A cloudless night is almost sure to be frosty. When the work has been nipped with the frost, the gloss may be brought out again by rubbing it over with a rag saturated with raw oil.

The Discoloration of White Paints.—A paint that absolutely and literally remains white for an unlimited period is unknown, and it is of interest, therefore to study even briefly the causes and conditions that lead to films of white paint changing color.

The principal causes that induce change of color may be grouped under one or the other of two heads:

(1) Causes outside the paint itself; as, for example, the presence of smoke, soot, dust, certain chemical gases, etc., in the air.

(2) Causes or conditions inherent in the paint itself or in the underlying surface.

Among the latter, a common and probably the dominant cause is the darkening in color of linseed oil on exposure. This darkening in color is a universal property of linseed oil, although it does not always proceed to the same limit. For example, the change in color may consist merely in a slight yellowing, or it may proceed to such an extent as to render what was originally a white surface deep ivory or stone color. This darkening in the dried linseed oil is usually aggravated by the action of the driers

contained in the paint, and certain drying materials are found to be much more prone to cause discoloration of the oil than others.

Now a curious fact is that, in spite of the natual tendency of all white paints (especially those containing a tangible proportion of linseed oil) to darken in color on exposure, it frequently happens that side by side with the darkening there proceeds a contrary bleaching action through the agency of the light; and these two actions may, under certain conditions, so neutralize and mutually destroy each other as to render the paint film almost permanently white during the life of the film.

In such cases it must not be supposed that there has been no tendency to darken, or that darkening would not have occurred had the conditions been favorable. What has really occurred is that the darkening has been stopped and neutralized by the bleaching action of the light. This bleaching action is believed to be due to the formation of minute quantities of peroxide of hydrogen, which is, as is well known, a powerful bleaching agent.

Chalking of White Lead.—The chalking of white paint on exposed surfaces is something which is peculiar to lead and does not in any way imply that the paint was not of the best quality. Adulterating white lead paint by adding whiting, would not increase its tendency to chalk. It would only mean less lead and more oil, and be equivalent to a thin coat, which could, perhaps, be applied just as well without the whiting. Whiting in oil has practically no body, therefore, it is of doubtful service as an adulterant of white lead except to prevent running. With red lead it is different.

"We are all familiar with lead paints chalking. Old work that is in this condition needs careful treatment, and a good, permanent job will be the result. I never allow any turpentine or so-called spreaders to go on any old work (meaning on the exterior, of course). Where such adulteration of paints (I may call it) is resorted to the under coating will remain brittle, and no top coat will last long."—*Correspondent.*

Paint Fading in Spots.—When paint fades in spots it is due many times to the fact that the last coat was not the same color as the coat underneath. The paint may have been carelessly put on, thinner in some places than in others. The thin places in time wear off and show the undercoat, while the thicker places will remain as put on.

Mildew is another cause. This happens usually in damp, hot weather, and is not always the fault of the paint or the painter. Mildew is a fungus growth which dyes and stains the paint. Conditions favorable to the growth of mildew may be caused by the use of too much japan, making the paint soft and tacky, or by using old paints which have stood open with dryers in them.

Paint Runs, Sags or Wrinkles.—Lead and oil paint runs and sags, only when mixed too thin, and too much put on, which is the case with all oil paints. Paint may run, sag, and fail to dry solid, because mixed with a compound largely made of coal oil, fish or rosin oil.

When given a good body and properly applied, pure white lead paint is the least liable to run or sag of any other paint, and it will sag or run only when improperly applied or mixed with bad oil.

Paint often wrinkles because of frost forming on it before the paint is dry, especially if the paint is mixed thin and flooded on. Paint may wrinkle in drying during hot weather, if mixed too thin and flooded on too plentifully.

Paint with good body will sometimes wrinkle if too much is put on to dry solid. Pitting is often caused by rain or hail before the paint dries.

Paint Tacky.—This most annoying trouble is often traceable to a soft undercoat. Sometimes the old fault of putting too much driers in undercoating is the cause, by giving the paint a hard surface before the air can oxidize the body of the paint. In such a case the oil never hardens, and would gradually cause the softening of the surface coats, even hard church oak varnish becoming tacky by this means.

Paint Blistering on Knots.—The knots having been coated with shellac, that makes a hard surface that paint does not adhere to well, and when the sun gets at it, the paint raises up easily.

Paint Scaling on Metals.—The scaling of paint on iron, zinc and other metals is due to three causes —sweating, expansion and contraction, and a non-porous surface. The sweating of the iron results in moisture, consequently in time the coat of paint is affected in a similar manner to that of the wet lumber. Contraction and expansion of iron and paint, being similar, results in the cracking of the paint, and its final dropping off. Cracking may be said to be due entirely to uneven expansion and contraction, as may be proved by applying a quick-drying coat of color over a slow-drying paint, or *vice versa*. Zinc

and galvanized iron are illustrations of a non-porous surface, the grain being so close that there is no foothold for the paint; therefore, such surfaces should first be roughed with an acid or oxidizing solution.

Running of Paint.—The running of paint may be due to two or three causes. The paint may be applied too thickly for the kind of paint used; for example, to put on as thick a coat of very thin paint as paint containing a larger percentage of pigment, would inevitably result in the paint running. Of course, linseed oil alone can be applied to a surface with a brush without running, provided too much is not put on, and the greater the percentage of liquid in a paint, the thinner the coat must necessarily be. This application of thin coats is a very common fault, especially in contract painting. Where the pigment is strong in coloring and covering power, the temptation is to put on very thin coats, which temptation is increased by the fact that thin coats dry quicker than thick ones. Of course, with proper care in using a very thin paint, there need be no difficulty from running. Another cause which may lead to running is want of proper grinding. The finer and better mixed the pigment and liquid are, the less the tendency to run. A paint mixed up by simply stirring the dry pigment into the liquid is more apt to run than one which has been ground. The oil leaves the coarser portions of the pigment, and carries off the finer portions with it, resulting in streaks down the work. With proper portions between the liquid and pigment, this difficulty can be obviated, but some pigments, as is well known, cannot be ground, and are therefore, always used by simply mixing with the liquid, but a paint otherwise good and properly proportioned

may give difficulty from running, if it was not finely enough ground. Still another cause of running is too long a time after the paint is put on before it sets. We have mixed up two paints, one of which would take a set, although not dry, in from six to eight hours, and another which would not take a set in twice that time, the amount of pigment and the grinding being exactly the same, and the second would run, while the first would not. It is very easy to see why this should be so. A thin layer composed of liquid and pigment, maintaining its limpidity, and being in a vertical position for a long time, will run off from the surface more readily than one which does not maintain its limpidity, although other things are the same. The paint which takes a set, thereby losing its limpidity, resists the strain which produces the flowing or running in the other paint. Adulterated oil, especially linseed oil, containing petroleum product, is liable to this same difficulty, and for the same reason, namely, the oil on the surface maintains its limpidity for a long time, thus giving gravity a long time in which to act upon the paint. The obvious remedy for running due to this cause is to use such an amount of drier, with pure oil, that it will take a set in from four to eight hours, and where the difficulty is due to adulterated oil, the remedy is apparent without explanation.

Brush Marks on Painted Work.—The difficulty of the brush marks remaining prominent in paint is largely a question of the relative amounts of liquid and pigment, although not wholly so. The nature of the liquid used comes in as an element. For example, if a large amount of very thick japan is a constituent of the paint, or a heavy, viscous, boiled oil, other

things being equal, the brush marks will have a tendency to be more prominent than where raw linseed oil and a limpid japan are used, but the proportions of liquid and pigment are, nevertheless, in all cases the important consideration. If the liquid is viscous and sluggish in movement, less pigment is required; with a very limpid liquid more pigment can be used, without causing the brush marks to be prominent. It is also quite probable that the grinding has an influence on the degree of permanence of the brush marks. Coarsely ground paint, under no circumstances, would allow the brush to flow out as readily as where the paint is in a very fine state of division, and with that perfect union between the pigment and the liquid which is produced by fine grinding.

Streaked and Spotted Painting.—Streaked or spotted painting may be due to two or three causes. It often happens that the pigments made use of are what may fairly be termed "composite," by which is meant different chemical substances constitute pigments, and often in cases where the pigment is nearly all one chemical substance, as in chrome yellow or white lead, it frequently follows that materials made at different times differ in both shade and fineness, but are subsequently mixed together. In cases where a pigment is composite, our experiments seem to indicate that there is a tendency for the very finest particles to separate from those which are coarser, so that each successive brushful taken out of the bucket may contain a larger percentage of the fine, and a smaller percentage of the coarse particles than the previous brushful, at least while the first half of the bucketful is being used out. In some paints it is actually noticeable that the last end of the job is

of a different shade from the first, especially if the painter has not stirred his bucket of paint frequently. This separation of the different constituents of the paint is also especially true of those composite pigments which are made up of some heavy bases, with some organic or light coloring matter; for example, Tuscan red, which, as is well known, is a mixture of oxide of iron known as Indian red, with some of the red lakes. It may fairly be claimed that this difficulty of spotted or streaked work is more a question of care on the part of the painter than of the proper mixing or proportioning of the paint, and this is to a certain extent true, but it is not wholly so. Poorly ground paint is especially liable to give streaked results, and no amount of subsequent stirring or mixing on the part of the painter will make a pigment consisting of very coarse and very fine particles a good one to spread, or make it give a good-looking job. Both fine grinding and great care on the part of the painter are essential to obviate this difficulty. It, of course, goes without saying, that those pigments which, from their nature, have a tendency to produce this difficulty, should not be mixed where it can be avoided, although in our belief fine grinding will almost entirely overcome it with any pigments, whatever they may be.

Peeling of Paint.—Also called scaling, and usually includes cracking. Causes, undry lumber, dampness back of the wood, ochre priming, defective old paint, resinous wood, boiled oil in the priming coat, barytes or zinc white in the priming coat, or in excessive amount in the succeeding coats, petroleum oil in the paint, fatty linseed oil, and bad paint mixtures. It is well known that paint will not adhere

permanently on a paint in which there is some form of petroleum oil. This is the worst fault of any form of petroleum oil in paint. Too much zinc white and too much barytes will both cause a too hard surface, and as a paint the mixture becomes very brittle and scales off. Ochre priming will not hold successive coats, as it is a very hard pigment. Also a priming coat made up mostly of dark colors will not hold well. Such a primer will cause cracking and curling of the paint when exposed to the weather, and blistering in shaded or protected parts. Dark color is preferred by some painters for priming with, because cheaper than white lead, and the work may be done with less care or trouble. Such a paint will not become sufficiently hard, and will cause trouble some time. Much paint scaling has its cause in painting done several years before, and done poorly, so that when a fresh coat is applied the under paint is softened up and causes the upper coating to yield.

A correspondent tells of a house that gives trouble every time it is painted, the house having been painted with a low-grade ready-mixed paint years ago. The only cure is to remove all the old paint. Or, if the remedy advised by one of our correspondents is correct, you can apply a coat of concentrated lye, made of such strength as will merely soften the paint a little, after which allow the surface to dry thoroughly, when a coat of good raw linseed oil paint may be applied, or as many coats as desired. This, he says, will give a good job.

Paint will crack if the under coats have not had time in which to become perfectly dry before the succeeding coats are applied. Mulder, the famous chemist, says this is because the under coat must have air, for even paint must breathe, or have oxygen,

and in order to get this the under coat of paint will rupture the upper coat. It is best always to allow a coat of paint several days to dry in before applying another coat.

A correspondent says: "I have the pleasure of saying that, after thirty years at the business, I have the first job of painting to peel for me. I have made many tests to ascertain why exterior walls as well as interior walls show paint deterioration. There is one house in this town that I painted 25 years ago, and it is in a better state of preservation to-day than many jobs done five years ago. Any painter may feel safe about his painting if he will be careful about the priming coat. The old way was to allow the priming coat to get quite dry, hard even, before applying the second coat, but now we apply the coats as fast as we can get them on. I use the best raw linseed oil and pure white lead for priming or other coats, and see that the surface that is to be painted is dry. I do not confine myself to my mixing of paint, however, but use any reputable ready-mixed paint, thinned with pure raw oil."

Blistering.—Blistering of paint is sometimes caused by dampness. The wood may appear to be dry, yet may contain some moisture, and when the paint is applied it does not sink into the wood, but dries on the surface; when the sun strikes such a place the paint will rise up, the heat of the sun causing the layer of paint to come away from the wood, and form a blister. Open such a blister and it will be found to contain moisture. Then in time the moisture goes back into the wood, not being able to get through the paint film, the latter drying and becom-

ing brittle. That is the life history of many a blister.

Blistering may be caused by a poor under coat of paint, the paint containing little pure oil, but mainly mineral oil, and over this the succeeding coats of paint will not stay, or will not adhere to the poor under coat. I have found to my entire satisfaction that where a paint has been thinned with more or less petroleum oil the upper coats will not attach, but will come away or form in blisters, in time. Or the upper surface will be full of fine cracks. Ochre of any kind, but particularly the cheap grades, thinned with any old thinner, will cause blistering of the paint. Alligatoring also comes from this source. As stated in another place, under the head of "Priming," the first, or priming coat, is a very important one, and if it is right there will be little trouble from blistering.

It has been noticed that dark color will blister worse than light paint, and this on shaded parts worst, as under porch roofs; on exposed parts the paint will crack or curl up. This blistering of paint is explained in this way: the dark pigments take up more oil, and do not dry as hard nor as soon as lead paint; and hence, when apparently dry, another coat is placed on top the under coat will soften up under the heat of the sun and cause cracking; in the shade blisters will ensue. You will often find dark bronze green blinds, for instance, full of blisters, while the door and window frames done with white paint will be solid. The more lead or zinc there is in a dark paint, the better for its durability.

Mr. W. G. Scott, a well-known chemist who has given much attention to the subject of paint, says of paint scaling and blistering:

The defect in painting known as blistering is due mostly to heat, but is governed indirectly by the presence of moisture and certain gases generated during the evaporation period, or to a rise in temperature. Certain colors draw the heat more than others. For instance, a reflecting surface, like white, yellow and red, will repel the heat rays. On the other hand, black, brown, and other dark colors absorb the heat rays. In similar manner, a lustrous suface will reflect the rays of light and heat to a much greater extent that a dull surface.

Gummy and resinous substances, also an excess of drying oil, have a tendency to accelerate the process of blistering; therefore, a pigment like lampblack, which requires a large amount of oil to produce a brush consistency paint, will be more likely to blister than white lead or zinc.

The scaling of paint not due to moisture is caused by applying a coat of coal oil or japan color over an old coat of paint which has become hard and greasy from smoke, etc. In this case the exterior coating is unable to get a hold; therefore, as soon as expansion and contraction begin the top coat is loosened and eventually falls off.

Sandpapering an enameled surface and subsequently washing with soap and water is the usual remedy in the above case with most painters, but some prefer to first wash with turpentine and then apply a coat of paint containing a small amount of varnish.

Silica, barytes, and other granular or crystalline pigments seldom scale, on account of moisture; whereas, the amorphous or non-crystalline pigments are seriously affected, owing to the fact that they form an enamel of non-porous paint when mixed with

oil. Ten per cent. of silica in a lead or zinc paint will generally make it porous enough to prevent scaling. Too much silica in a paint, however, is a bad thing, as it allows the moisture to enter, as well as to escape from the painted wood. Furthermore, it reduces the covering and hiding capacity of the mixture.

A car painter says that when blisters arise on a car panel, under the varnish, as they will sometimes on a hot day, and when the varnish is fresh, simply puncturing the blister with a pin will allow the air to escape, after which the blister will go back and attach to the surface as good as ever. This is worthy of trial, in any event.

Paint often blisters on knots that have been shellaced, because on such a hard surface as shellac the paint cannot get a footing in the wood, and hence remains on top, subject to the heat of the sun, which softens it and forms a blister. Or it may be that the heat softens the pitch of the knot.

Blistering is sometimes caused by too heavy coats of paint, which do not dry perfectly or fast enough to get out of the way of the action of the sun. The priming coat, especially, ought not to be heavy, but thin. If ochre must be used for priming, then add some white lead to it, and use best ochre.

If you have old work to repaint, be sure to make the surface clean and especially have it free from any grease. Paint will not dry over grease, and grease and dirt are prolific causes of paint troubles many a time. By way of experiment, apply some grease to a part of a painted door, say, and rub it out thin; then paint the door, and see how long the paint will be in drying over the grease spot. It will never dry.

Nearly all dark colors will blister when exposed to the direct action of the sun, in warm weather. Bronze green is perhaps the worst of all dark colors in this respect.

A painter says he knew a man whose house blistered badly, and he told the man to wash the blistered places with strong cider vinegar, then let this dry, and then touch up the parts that had been sized with vinegar and paint. Then let the paint dry for a few days, after which a coating can be given the entire surface. After three years, this job, done this way, showed no signs of peeling or other deterioration, he said.

Applying a quick or hard drying coat of paint over one that is more elastic is sure to cause trouble. The paint is almost sure to crack, in time.

A painter asks advice about repainting a blistered door. Burn off all the old paint, laying the door on a pair of trestles, if possible, and if not convenient then do the work as the door hangs. Then sandpaper the surface until quite smooth, dust off, and apply a thin coat of white lead and raw oil primer, with a little japan. Rub this well into the wood, and brush it out well. Use a little turpentine, but very little driers. If the finish is to be dark, then color the priming a little to match. If to be oak, then do not use ochre in the priming, but tint with a little yellow chrome, or red lead. Allow this coat at least two days to dry, then sandpaper with fine paper, and dust off. Use thin coats that will dry hard. Heavy paint and much oil is at the bottom of many a case of blistering of paint.

SPOTTING.—On two-coat work poor lumber and thin paint often cause spots on the painted surface.

The oil sinks into the cross-grained or soft parts of the wood, and leaves very little paint there; in consequence of which the painted parts will fade out or become spotty. To remedy this go over all such places after the priming is dry, with a touch up coat, and when this is dry apply the regular second coat.

Laps, due to improper painting or brushing out, will cause a certain kind of spotting, the laps showing heavier on account of being composed of more paint than the rest of the surface. Such spots show worst the older the paint becomes, due to quicker fading out of the thinner parts.

Peeling Caused by Ochre Primer.—Being of different physical construction, ochre will not amalgamate with the lead mixtures of the later coats, but forms a separate and distinct coating of and by itself, while succeeding coatings with lead base united together and in turn and of themselves formed a separate and distinct coating. And the paint peeled later on for the simple reason that the oil carried to the old coating by succeeding coats of paint, could not and did not penetrate and revivify the old ochre coating, nor could the new oil penetrate and revive the old oil in the wood itself. When the oil died a natural death, and when the paint mass finally became too heavy for the adhesive that held the succeeding paint coats to the surface, and following the contractions and expansions of surface during extremes of weather, the paint peeled down to the impregnable surface formed by the ochre, or peeled off down to the dry original surface itself.

For the best results use only those materials that are physically and chemically alike and will permit the life-giving quality of the oil of succeeding coats to

thoroughly penetrate and revive, or replace the oil, not only in the preceding coats, but in the original surface itself.

Livering or Thickening of Paint.—The livering or thickening of paint is a condition often observed by the painter when a batch of paint is allowed to stand uncovered for any considerable time. This livering is generally the result of saponification or soap-making action. As all are aware, soap is made by combining an oil and an alkali. Some pigments are alkaline, and when they are ground in linseed oil they form metallic soaps. These soaps are really driers, and cause paints in which they are formed to dry readily to a hard film. In some cases they dry very rapidly, and produce such a hard film that checking and cracking result, a condition often observed when paint is burned up with added drier.

In a recent study of oils, it was found that pigments such as barytes, silica, china clay, etc., had a great drying effect upon linseed oil. This seemed strange, for these pigments have always been considered as inert or non-active pigments. The writer has always contended, however, that the peculiar drying value which these pigments exert is not due to chemical action which would involve the formation of metallic soaps, but is due instead to the physical action which these pigments have in spreading out the surface of linseed oil and giving it a better opportunity to dry by the action of the oxygen of the air. It is true, however, that some pigments actually do have a soap-making effect, which causes too rapid drying, and, in order to determine the relative chemical action of pigments upon oil, the writer has conducted a series of tests. The results of these tests

conclusively prove that the inert pigments in question are really chemically inert, and have absolutely no chemical action upon linseed oil. Their action is entirely a physical or contact action.

Summing up the results it seems fair to conclude that the inert pigments so-called are really inert chemically, and that the lead and zinc pigments are chemically active. It would seem advisable, therefore, to use in paints made of the chemically active pigments a moderate percentage of the inert pigments, so that any marked saponification would not take place. The saponification of oil by either lead or zinc pigments is apt to result in early disintegration, as shown by exposure tests.—*H. A. Gardner.*

As soon as the plasterers are done, and very often before, you are required to rush the paint, and maybe the temperature near zero. Often we are asked to put on two coats in one day. The wood may be wet and even frozen, and you paint on this. The result—scaling later on, when the paint dries and the wood dries and shrinks.

"In painting a building of this kind, when your paint becomes dry the boards will shrink, and this makes your work look as though it was pushed together, and when it gets damp and dry again it will make your paint get full of small cracks hardly visible to the naked eye. The paint gets harder, and the woodwork drying and swelling will soon let the rain in these small cracks and get behind the paint and cause it to peel or scale. Some buildings are so low the sills never dry. There will be a continual moisture between those boards and plaster, and paint is sure to blister when the sun shines on it.

"I was once called upon to examine a row of eight or ten houses, and though no scales or blister were visible, it looked as though black coffee had been poured over it from the cornice down. This was caused by the sun shining against the side of the house, and forced the dampness to ooze out every crack and crevice. The siding proved to be chestnut.

"There is a reason for blistering and scaling, and it should be studied by every master painter, so as to explain to his customer the cause. Woodwork may appear dry when painted, and the moisture invisible; therefore when painted the oil instead of penetrating will lay on the surface and when dry you can look for that part to peel, and when the sun strikes it will cause a suction and form a blister, which if opened will be found full of water, and if let alone the moisture will again go back into the wood, and the blister when hard will break."—*Anon.*

"The normal amount of moisture or water in seasoned lumber is about twelve per cent.; consequently, if green lumber containing sixteen to twenty per cent. of water be allowed to dry naturally, or season, the excess of vapor will be driven off in the form of vapor. On the other hand, if seasoned lumber containing twelve per cent. of moisture be kiln-dried to such an extent that the moisture is reduced to eight per cent., such material, on exposure to the weather, will in time take up enough water to make up the deficiency, or in other words, it will absorb four per cent. of moisture.

"This is the cause of the highly kiln-dried doors and sashes swelling and becoming very tight-fitting. With green lumber the reverse effect is produced, and

the doors or sashes shrink to such an extent that they soon become quite loose.

"If green lumber be painted, it is reasonable to expect that something must give way when the excess of moisture tries to escape by the evaporation route. If the paint be porous enough, the moisture will pass through the film of paint without doing any material damage; whereas, with a non-porous paint or enamel the water cannot get through, and consequently forces the film to give way in its effort to escape."—*W. G. Scott.*

"Priming with some cheap ochres which are ground in oil but do not contain one drop of linseed oil are used, not because painters do not know that they contain no linseed oil, but because they are cheap. When your priming is applied you may wait perhaps two or three weeks before it is dry enough to apply the second coat. You may use or mix your own second coating, which you may think is O. K., but when you put it on it will dry but not adhere to the priming, which contains bad oils and causes it to blister. A good primer is the main foundation for a good job. A poor primer will cause your paint to blister or alligator and the bad oil paints will be tacky for years, and where the sun or rain strikes your work it will require repainting in a short time. Then when one is called upon to paint over this dope with good paint, it is up to the master painter to explain to his customer that the old paint contained bad oil. Tacky paint comes from non-drying oil. Painted over with good paint, the result will be blistering and 'alligator.'"

Mildewing.—A serious trouble, but of infrequency. Probably induced by dampness or shade,

and is produced in connection with certain pigments more than with certain others. Oil containing some foots may induce it. It may occur between two coats of paint, or on the bare wood, under the paint. Its effects are to spoil the appearance of a painted surfare, and in its worst form may cause destruction of paint coat. Climate may perhaps have more to do with the trouble than any other one cause. Painting in damp weather, when the weather is very warm, or painting in damp or foggy weather in ordinary summer weather is a prolific cause of mildew. Paint applied to a cold surface and succeeded by warmer weather may be the cause of it. If mildew occurs on one building and not on one adjoining and done at the same time, we may look for the cause in condition of the wood. Surrounding trees and shrubbery, making much shade, favors mildewing.

Mildew has its origin in minute spores or seeds of a plant. There are two kinds, one a parasite living on live tissue, the other living on dead matter. In the latter we recognize paint mildew. It occurs as well on linen, wall paper, leather, etc., in presence of dampness. Smut, vegetable rust, etc., are other forms of this mildew. It thrives best where there is heat and moisture. On paint, developing from an invisible spore, in a few hours it becomes a quite visible black spot or speck, this growing rapidly into a dark brown or reddish splotch. These black or dark brown streaks or spots are by far the most serious growths, destroying the life and the adhesive quality of the paint, and causing it to lose color and become powdery. If allowed to remain it will destroy the wood, which will have the appearance of having been burned, and the black or brown spots under the microscope will have the appearance of soot. Surfaces

painted with pure white lead or oxide of zinc are less liable to mildew than those painted with ochres or any similar earth pigments. Being ground very fine, lead and zinc form a harder surface and one more impervious to moisture, hence more immune from mildew.

There are many so-called remedies for paint mildew, but none can be accepted as absolute cures or preventives. Spirits of turpentine will destroy bad cases of mildew, and the parts should be well sandpapered before the turpentine is applied. Remove any loose paint. After the turpentine, sandpaper again, and apply a coat of paint, well flatted, with the rest of the coats mixed with oil in the usual way. In close rooms, cellars, etc., apply powdered sulphur, not by flame, but by dusting it on. Or lay it around, fumes escaping from it. This method has long been in use in greenhouses, where mildew often appears as a sort of bloom or downy mildlew. Ventilation of closed rooms, etc., is advised, and fresh lime wash with some bluestone in it is good. Copper sulphate or bluestone solution is also good for drop cloths and ropes, to preserve them and preventing or killing mildew.

For brick or concrete walls subject to mildew it is advised to apply this mixture: Dissolve a pound of paraffin wax in one gallon of benzine and apply to the wall with a paint brush, rubbing the liquid well into the surface. A master painter washed down a mildewed house with a soap powder and hot water solution, rinsing down with clear water, letting it dry, then painted with a paint made of 85 per cent. white lead and 15 per cent. zinc white. The house was wearing well some time after this treatment. In fact, turpentine and the washing with soap powder or alkali of some kind are the only sure remedies.

Mildewing at the seaside is to be prevented by using a compound of zinc white, 80 per cent., and white lead, 20 per cent., with plenty of turpentine, first coat. Second coat, lead 15 per cent., zinc 25 per cent., all oil. This paint is regarded as being the only paint that will stand successfully on the seashore. Mixture of lead, zinc and whiting did not stand, it soon powdered. From 30 to 40 per cent gave a paint that did not blister nor scale, the priming coat being boiled oil.—*Vide* report.

Mildew hardly ever appears on a hard-drying paint, and most frequently on a paint composed of coarse, loose pigment material. Finely ground pigments are best where danger from mildew exists. White lead paint appears to mildew worse than zinc white paint; an old painter says he never heard of a zinc paint mildewing. Greens are very liable to mildew.

Handy Things to Have

Handy Brush Wiper.—Take a piece of No. 9 sofe wire, about 15 inches long, and bend up each end four inches, and place this in the paint pot, about $1\frac{1}{2}$ inches from the top; then bend the ends out over the edge of top, and you will have a brush wiper that may be taken off and thrown into the lye barrel when dirty, or it may be wiped off with a rag before paint dries on it. This saves the pot from getting so dirty, as it will when the brush is wiped on its edges. A painter tells how he makes a wiper. He takes a mixed paint can and opens it by cutting around the top for about three-quarters of its circumference, leaving one-quarter uncut, and this part is turned up, forming a wiper. This can only be done with mixed paint cans.

Simple Brush Keeper.—Take a common wooden bucket and place hooks on the inside, to which hang the brushes so that they will be in water up to the bridling, without the ends of the bristles resting on bottom. It would be best to paint the inside of the bucket, to prevent water-soaking. Never leave a new brush in water, at least not until it has been soaked well in paint.

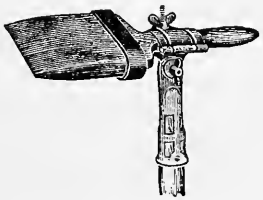
Preserving Small Cans of Mixed Colors.—It is sometimes necessary to keep some small cans of colors over, and to prevent drying over or skinning, have a round, shallow pan, and a deep tin slightly smaller than the pan in circumference, and deep enough to receive the paint cups. Partly fill the shallow pan with water, and in this place the can of color, inverting the other pan over it, making an air-tight and dust-proof keeper. Putty also may be kept moist in this way, placing it in a cup.

Keeping Shellac for Knots.—Shellac being mixed with alcohol, it evaporates quickly if left exposed to the air, hence it has been the practice to use a wide-mouthed bottle for keeping it in, with a hole in the cork to take the end of the brush handle, thus keeping out the air more or less perfectly, and keeping the brush moist. Another plan is to have a leather or rubber washer that will fit inside the wide neck, while a suitable lid may be used for covering the top, so that the brush, handle and all, are closed inside the bottle.

A Handy Oil Filter.—A very good home-made oil filter requires only two cans and a supply of cotton wicking. The cans are placed on different levels,

and the upper one filled with the oil to be filtered. The cotton wicking is saturated with clean oil, and is suspended over the edge of the uppen can, forming a capillary syphon. The end of the wicking should be allowed to touch, or lie, on the bottom of the upper can. The capacity is only limited by the size of the cans and the number of wicks used.

Extension Brush Holder.—One of the modern helps for the painter is the brush holder, taking the place of what we used to call a man-help. The latter we made with a long, slender pole, to the end of which a brush was tied, and with this the lofty and not-easy-to-get-at places were painted. Now we have metal adjustable holders that can be adjusted to a pole and brush in a moment, and the brush placed at any desired angle, there being at least two of these devices on the market, and selling at about 75 cents. No painter can afford to be without one or more of these little tools. They weigh about 10 ounces, and can easily be carried in a pocket. In one of them, at least, any kind of a brush may be fastened.



Nelson's Patent Brush Holder

To Prevent Paint Running Down Brush Handle.—When doing overhead work the paint is apt to run down the handle of the brush, and some one suggests cutting a hollow rubber ball in two and

running the brush handle through one of the halves, with the open part towards the ends of the bristles, and on butt of brush; this cup will catch the paint.

Roof Jack.—When painting or staining a roof how unhandy it is to set the pot so that it will not slide away. Various devices are used, mostly a jack to fit the slope of the roof, with nails or sharp irons at the base to catch in the shingles and prevent it slipping.

Caps or Lids for Paint Pot.—How nice it would be if we had a lid for the paint pot, something that could be slipped on to the bottom of the pot when we were using the pot, and when done could clip it on to the top, keeping air and dust from the mixed paint.

Notes on Iron Painting

—Old painted ironware should have all paint, rust and scale removed by burning off, and then have a coating of turpentine or benzine. Then paint as for new ironwork.

—For wrought iron, such as grilles, railings, etc., nothing is so effective as a dull or dead black finish.

—In former years oxide of iron was considered the ideal paint for iron, but red lead now has the call.

—Elasticity is an important feature of the durability of a paint for metal, and this depends more upon the vehicle than the pigment. A proper combination of the two is best.

—Dry, metallic brown paint will take as much as 15 gallons of oil to bring it to a painting consistency, where red lead will require only from three to four gallons.

—Keep a coat of paint on iron free from any opening through which the iron may be reached by external influences, and have its co-efficient expansion properly adusted, and you attain the maximum of durability.

—Many engineers agree that the best coating for ironwork is a mixture of two parts of red lead and one part of white lead. This for prime and second coats. White lead is too porous, while red lead is not porous, but forms a hard, non-porous yet elastic coating that is impervious to moisture. White lead alone is too soft.

—Coal tar and asphalt are much used by makers of certain kinds of iron work, to protect the iron from rust. The articles are dipped while hot into the mixture.

—Lampblack and graphite are often used with red lead and oil, not necessarily to improve the lasting qualities of the pigment, but to make the paint work smoothly and evenly.

—To paint ironwork in imitation of stone, make the last coat quite heavy, and apply it freely; when it has begun to set dust on some of the stone, crushed, that is to be imitated, though the common way is to make the paint a suitable color, say like the stone, and apply clean sand.

—For painting on iron add a gallon of oil to the 25 lbs. of dry red lead, and stir the oil in gradually. Strain. No driers are needed, unless a very quick job is desired, in which case add a gill of the best turpentine japan. This will make about a gallon and one-half of paint, and will cover about a thousand square feet of average surface.

—To paint new iron see that it is dry and clean. Apply a coat of very thin red lead paint, so that it will enter the pores of the iron. Follow with two or three coats in which either red or white lead figure.

—Never paint iron while it is damp, or when the weather is damp; early morning and evening are bad. Paint on a dry, warm, windy day, if possible.

—An expert says that raw linseed alone is the best priming for iron or steel, rusted or not. Where there is rust the oil absorbs the oxygen contained in the rust and converts the whole mass into paint, and this coating protects the metal from chemical action and any combination of paint that may be put on it. He adds that this has been his experience in making tests for several years.

—Another expert advises oil for the priming coat. First make the surface clean, then go over the surface with a steel brush dipped in hot oil, and when

this coating of oil has become tacky, apply a coat of paint. "Objects thus painted will preserve the coat or color from heat or cold, excessive moisture or dryness, for an indefinite period."

—A rust-preventing paint may be made thus: Grind together 2½ gals. of raw oil, 60 lbs. red lead, 30 lbs. zinc oxide, and 10 lbs. graphite. This paste must be thinned for use. The color is a reddish chocolate, and it dries rapidly, consequently it should not be prepared too long in advance of need. One-half pound of beeswax, melted, to the gallon of oil, will retard the hardening; so will China clay.

—A paint used by the elevated roads in New York city is as follows: Boiled linseed oil, 9 parts; turps, 1 part; red oxide of iron, very finely ground, 7½ parts.

—Graphite ground in boiled oil makes a very durable paint for iron. It works freely under the brush, has great covering power, is neutral and is not affected by gases or water.

Painting on Metals

Painting on Copper.—Make up and apply a solution of copper sulphate and a little nitric acid, in water, which will roughen the surface and enable the paint to get a footing. Or try a mixture of one part acetone, and two parts benzol, which is, in fact, a paint and varnish remover; let it dry, and apply the paint, which, a painter tells us, will hold.

Painting on Sheet Lead.—It is difficult to paint over lead so that it will hold. One way is to roughen the surface with sandpaper, but it is rather the nature or character of lead that makes it repel paint. Certain pigments do best, for instance, iron oxide takes better than ochre or any earth pigment.

Painting Rain Spouts.—Water spouts and eaves troughs would be the better for having the insides, as well as outsides painted. Pipes may be painted inside before they are put up, by pouring thin paint into them and turning the pipe around until the interior is coated. Some one had suggested painting a water pipe, in position, by running a sponge of paint up and down by a string from above and below.

Painting Refrigerator Pipes.—Pipes in refrigerating plants should be painted or enameled before any fluid goes through, using a good common grade of enamel paint. The partitions, made of cork plaster, are given five coats of enamel paint. Some use aluminum bronze paint, others say finely ground cork, made into paint, is best.

White Paint for Stoves.—Scott gives the following formula for a "fireproof white," made to withstand heat:

(*a*) 16 fl. oz. waterglass solution, 36 B.
6 fl. oz. water.
2 fl. oz. light syrup of white sugar.
(*b*) 8 oz. China clay.
2 oz. pulverized soapstone.
2 oz. zinc oxide.

Mix (a) and (b) together. This paint burns first to a light gray, but finally becomes white; by leaving out the syrup the paint becomes white at once. The purpose of the syrup is to prevent the waterglass setting too soon. Light syrup will do in place of the sugar syrup.

Aluminum Paint for Stoves.—A correspondent tells us he has had success by mixing aluminum pow-

der with common copal varnish, thinning with turpentine. Would not a baking varnish do better? The stove must be made clean first. This writer informs us that he has had stoves to look well after six years, and school radiators were bright at the end of five years, done with this bronze. Of course the top of a cook stove gets much wear, and will not wear as well as other parts, but renewing with paint is easier than forever blacking the stove.

Asphaltum Varnish.—This is the varnish to use when you have a heater pipe, stove pipe, etc., to coat, but the best grade should be used, thinned with turpentine only.

A Cheap Black Paint for Iron.—Mix 56 lbs. white lead, 112 lbs. barytes, 25 lbs. gas black, 18 lbs. boiled linseed oil and 12 lbs. raw linseed oil, with cheap driers to suit.

Soapstone Paint.—Steatite or soapstone is highly spoken of as a paint for iron or wood, it not being affected by the weather, as most pigments are. It is not affected by heat, cold, frost, air, gas, paint or acids, and with varnish it makes a beautiful enamel paint, being quite durable, of course. The paint flows well, and sticks to metal or wood tenaciously.

Colors for Ornamental Iron Work.—The color most used is, for iron railings, a dark green or brown shade with the tips and central floral ornaments in gold or bronze color, if a pleasing effect is desired. Two or three coats should be given. For wrought iron or grill work, nothing looks better than a perfectly dull black.

Bronze Green for Railings.—Sift and grind together in the dry state and then mix with 5 oz. japan the following: 2 lbs. chrome green, 1 oz. lampblack, and 1 oz. medium chrome yellow. Grind this in a mill, then thin with enough raw oil to form a paint of brushing consistency.

Non-poisonous Paint for Iron.—This is a German patent: Take powdered coke, zinc blende, and Pompeii red, and grind in boiled oil. This paint is said to be non-poisonous, and proof against alkalis, acids and the weather. Zinc blende is a zinc ore, which miners call "black jack."

Tarred Water Pipes.—If the vent or soil pipe, or other pipe, be coated with gas tar, as they often are, and it is desired to paint them, size with shellac varnish, which will prevent the tar from discoloring the paint. Gas tar will crack bronzing and eat through oil paint.

Colors for Machinery.—Some good color combinations for machinery are: Deep blue and golden brown; black and warm brown; chocolate and light blue; maroon and warm green; deep red and gray. Lead or slate are the most used, however.

Wire Screen Paint.—A black paint may be made by thinning drop black, ground in oil, with turpentine, with a little liquid drier and some asphaltum varnish, say one-third as much asphaltum as black paint. Strain carefully.

Black Paint for Hot Water Pipes.—Mix lampblack with boiled oil and add one-half pint of

driers to each two gallons of the paint. This paint is suitable for boilers, is not liable to crack, and no odor is present after an hour or two.

Painting Water Pipes.—On account of moisture, water pipes should not be painted while cold water is in them; let the water out, wipe dry, coat with varnish, followed by paint. The varnish coat should be thinned well with turpentine. Or shellac may be used instead, though we think copal varnish better, holding more tenaciously and taking paint better.

Cleaning Aluminum Metal.—Take equal parts of alcohol and sweet oil, well mixed, and clean the metal with it. Some use a diluted lye, some benzol. To get a good polish, after cleaning off, make a paste of fine emery powder and tallow, and follow with a rubbing with rouge and turpentine paste.

Good Paint for Fire-work.—Boil pure raw linseed oil with as much litharge as will make it of a brushing consistency; to each 10 parts of litharge add 1 part of lampblack; boil the mass for three hours over a gentle fire. The first coat should be thinner than the following coats.

Good Paint for Iron-work.—A railroad chemist, who made a study of paints, gave this formula as a good one for painting ironwork. Best French yellow ochre, 39 lbs., lampblack, 1 lb., pure raw linseed oil, 54 lbs., japan drier, 6 lbs.

Painting a Bird Cage.—Never use white lead for this purpose. Mix zinc white to a stiff paste with varnish, and thin with turpentine. Cage makers bake

the enamel paint on, and this anybody may do if he has an oven large enough, and bringing the heat up to about 150°, and keeping it there. For the process of baking enamel paint, see another part of this work.

PAINT FOR METAL ROOF.—This is an imitation slate roofing paint given by Scott:

Lead zinc	20 lbs.
Whiting	10 lbs.
Portland cement	5 lbs.
Graphite	15 lbs.
Lampblack	1 lb.

Grind in—

Boiled oil	3 gals.

This gives a dark gray slate color, and may be made a beautiful deep olive-green by substituting 2 to 5 lbs. chrome yellow in place of the lampblack. Thin out with boiled oil.

If used for shingles, Scott advises thinning out with coal oil, 1 part, and boiled oil, 2 parts. Strange as it may seem, this kerosene paint is wonderfully durable on wood, but is a failure on metal, the kerosene being unable to penetrate the metal (*vide* Scott.)

PAINT FOR SMOKESTACK.—Mix pulverized graphite with thinned coal tar, and mix to a brushing consistency.

MOISTURE ON IRON PLATES.—To remedy this evil we may copy the practice of the ship painter, who prevents condensation of moisture by the following means: The iron plates are first got dry, then several coats of red lead paint are applied, and on the last coat, while fresh, fine cork powder is dashed against it until no more will adhere. This cork coating is then

painted any desired shade, the paint being flatted with turpentine.

PAINTING STEEL WATER TANK.—The priming should be red lead paint, and the finish may also be this, and there is no danger even where the water is to be used for drinking. At least the danger from lead poisoning is extremely small, the quantity used being so small. Where water from red lead coated water tanks is in use, no case of lead poisoning has ever been reported. Outside of the water tank a carbon paint, or graphite paint may be used.

PAINTING HOT BOILER FRONT.—Asphaltum is commonly used here, but if a paint of lighter color is desired, one must be used that will stand the heat. A steel-colored paint, such as that indicated for machinery, would do here, and a mixture of zinc white in oil and lampblack in oil for coloring would make a good paint; thin with boiled oil. Apply this paint while the boiler front is warm.

PAINTING ON ZINC.—As zinc and galvanized iron are practically the same, as far as painting is concerned, the treatment of one will apply to the other. The usual method is to cut the surface with this mixture: To a gallon of water add two ounces each of copper chloride, copper nitrate, and sal ammoniac; puverize these chemicals, and stir them into the water. Then add two ounces of muriatic (hydrochloric) acid; stir until dissolution of ingredients is complete. Apply this wash with a whitewash brush and let it dry. The color at first will be black, but changes to a gray. It is now ready to be painted in the usual way. Mix the chemicals in an earthen vessel, not in a metal one.

The first coat of paint on zinc or galvanized work should be made from white lead, red lead, and turpentine, with a little varnish as a binder.

New rolled zinc sheeting may be washed with a weak solution of hydrochloric or nitric acid, say a tablespoonful to the gallon of water. Some scratch the surface with sandpaper, using a No. 2 paper, but the chemical or acid treatment saves time and labor, and we think, makes a better job.

Some make a boiled oil specially for zinc painting, the method consisting in mixing 1 part binoxide of manganese coarsely powdered, but not dusty, with 10 parts of linseed oil. Keep heated and stir frequently for thirty hours. The oil will then begin to turn a reddish brown, and will do for almost any kind of paint.

Tarnished zinc may be cleaned with a mixture of 1 part of sulphuric acid to 12 parts of water, rubbing with a rag, then rinsing with cold water.

Protecting Zinc Roofing from Rust.—Where it is not desired to paint the roofing, the plates may be immersed in water in which 5 per cent. of sulphuric acid has been placed, then wash with clear water, allow to dry, then coat with asphalt varnish, made by dissolving 1 to 2 parts of asphalt in 10 parts benzine; pour this solution evenly over the plates, then place the plates in an upright position to dry.

Bronzing Ironwork.—To a pint of alcohol add 4 ounces gum shellac and ½ oz. benzoin; set in warm place and agitate once in a while. After gums have dissolved allow the mass to settle two days in a cool place. Then pour off the clear portion into another bottle, and keep well corked. To what was left in

the first bottle add enough alcohol to make it work easy, strain through a fine cloth, and use as a first-coater. Now take ½ lb. finely ground bronze (green), thin with varnish, and add coloring matter. If possible warm the iron a little, and apply the bronze with a soft brush; repeat if necessary. A coat of varnish will protect the bronze. The color of the bronze may be varied by the use of lampblack, ochre, etc. Parts in relief may be done with bronze of desired shade. Coat until you have a uniform and solid surface, and protect it with varnish.

To Paint Magnets.—Take one part of white shellac and two parts of Venice turpentine, color with three parts of English vermillion. Melt the shellac and Venice turpentine on the stove until fluid, then set aside to cool to 140°. Then thin with 95 per cent. alcohol, adding also 10 parts of the alcohol. Rub the vermillion with alcohol to a paste, then add the shellac and turpentine mixture. Place the mass on a water bath for a few minutes, then stir until smooth. Remove from bath and stir until cold. Keep in a well-stoppered bottle and heat when wanted for use. Warm the magnet before painting it.

Painting Elevator Sides.—Four years ago I painted an elevator, the sides of which were of iron. The owner had been unable to secure anyone to paint it so that the paint would last over one year. One reason why this was the case was, the elevator was in a low situation, or damp. When I undertook the job it was all red with iron rust, or iron oxide. I scraped this off clean and applied a coat of lampblack in oil, the oil being merely tinted with the black. After six days I gave the second coat, using a little more lamp-

black than in the first coat. It is certainly good for another year, or five years in all. If there is anything better than this treatment I should like to learn of it.—*F. G. Pratt, Chelmsford, Mass.*

Practical Paint Notes

A building that is to be painted should have a special treatment, both as to color and to paint.

Never second or third coat the inside of a house while the plaster is drying out.

In the meantime open all windows and doors and let in all the air possible.

Too much driers will retard drying and make a soft, spongy paint surface.

Break up colors in stiff lead, then add the thinners, which stir in, then add the driers. Stir all thoroughly together.

Never prime outside woodwork in damp, foggy or threatening weather. In fact, it is not safe to apply any coat on outside under such conditions.

When stippling paint learn to use the brush firmly but gently; don't pound the surface with it.

When painting a room in colors to agree with the wall paper never match one or two of the colors, but rather mix the paint to represent the general color effects of the hangings.

In dry, warm weather we might with advantage omit all driers in outside paint.

When priming fill the wood full of paint, and especially the sappy parts, where paint naturally sinks in; better touch up such places after the priming is dry, either with paint or shellac. This will make a uniformly solid surface.

A little turpentine is good in priming coats on any wood, but do not use too much.

Better no turps in the last coat, exterior, as the oil coat will last better than one with some turpentine in it.

To harden asphaltum varnish add a gill of shellac to the gallon of asphaltum.

Cover cans of japan color with turpentine, and cans of oil color with water.

Don't add driers to paint until you are ready to use it, particularly in warm weather.

When you paint a wall in color have the priming coat a little lighter in color than the second coat, and if you have the priming darker than the next coats when the finish is to be light you will have spotty paint.

As soon as paint shows the signs of blistering remove it at once, for the longer it remains the worse it will become.

The condition of a surface to which paint is applied largely determines the durability of the paint.

Wood alcohol is miscible with water in all proportions, but not with fixed oil.

Plain painted surface having a peach-like bloom will result from the use of a slightly chalky flat over a decidedly richer oil color.

A sticky paint surface may sometimes be made hard by being well rubbed with a liquid composed of equal parts of japan and turpentine, using a stiff brush.

When done with paint pots wipe them down inside with the brush, and wipe off the outside with a rag.

Orange red will cover over black better than any other color, using one coat only.

If it appears that the paint mixed with boiled oil is drying too fast, as in warm weather, better add a little raw oil to it, to slow it up.

Large surfaces may be easily and evenly finished with paint by stippling.

Use pure raw oil in exterior painting, and under no circumstances add any coal oil to it, as it will surely cause spotting or fading, and also possibly peeling, for paint over it will not stay.

In warm weather it is usually best not to add the driers until you are ready to apply the paint, but if mixed with the paste lead it will not oxidize as it does when thinned with oil.

Strain all paint, and if colors are added to it, strain afterwards. Stir the paint well after straining, and keep the paint in the pot stirred while using, as the thinner will come to the top and be used up first if not kept stirred.

If the paint becomes dirty while in use, with sticks, etc., in it, better strain again. A paint strainer well used pays 20 per cent.

As a rule, better painting may be done with a round brush than with a flat one. Paint is not as easily rubbed out out with a flat brush, but you can get over more surface with it. An oval brush is of course as good as a round one in this respect.

Old lead is better than new, but owing to its being much harder it requires a longer time in mixing.

Chalking of lead may be due to various causes, too little oil, applying second coat before the first is dry, etc.

Varnish Colors

Varnish colors differ from the pure enamels in that the pigment part is generally a positive color in place of a tint, and that the paste pigment instead of being ground in varnish is ground in oil, gum japan, or a mixture of the two, and then mixed with the vehicle.

If the pigment be ground in oil, then a short-oil varnish must be used for mixing; conversely, a japan color would require a long-oil varnish.

By grinding the pigments in a mixture of prepared oil and a special gum japan, a paste may be made that will mix with any varnish.

Zinc oxide and a few other pigments may be ground in varnish without injury, but most of the pigments, especially those containing grit, cannot be ground fine enough in varnish without material damage to the gum, in which case the varnish soon thickens up, or "livers."

Varnish colors may be divided into three distinct classes, viz.: those containing an opaque pigment, like the vermilion toners; and the colored containing a transparent pigment, like the vermilion toners; and the colored varnishes, where the color is imparted in the varnish by means of an oil soluble dye. The two first classes are more or less permanent to light, while the latter is quite fugitive, and soon fades when exposed to strong sunlight. The value of a varnish color depends upon the permanency and fineness of the pigment, and the kind of varnish used for mixing.

The amount of paste color required to produce a perfect working varnish color will vary with the pigment; whereas a pound of carbon black paste to a gallon of varnish is sufficient to form an opaque coat over white, from two to four pounds of chrome yellow, vermilion, etc., will be required.

The preparation of a satisfactory varnish color is a somewhat difficult matter and requires considerable experience. Too much varnish results in a transparent product with a poor covering capacity; too much pigment induces flatness and makes the color hard working.

Varnish colors are usually made air-drying, but when made for baking it is customary to call them enamels. The light colors are generally baked from two to six hours at a temperature of 120 degrees to 140 degrees, F.; the darker colors at a temperature of 140 degrees to 200 degrees, F.

Black baking japans are not classed as color varnishes; they usually contain asphaltum, pitch, Prussian blue, or some similar substance and are designed to stand a high heat.

The celebrated French "Jet Enamel" is composed of asphaltum, black oxide of manganese, linseed oil and kerosene. This enamel will stand a baking heat of 500 degrees, F., and the resultant coat is as hard as iron.

—Scott.

Ready-Mixed Paints.—When the introduction of such prepared paints was first attempted, technical knowledge in the paint industry was not in nearly so advanced a state as it is now, and they were far from being the scientific products that they are to-day. The great technical problem connected with their manufacture is that of overcoming the tendency for the pigments to separate out from the vehicle on standing, which results in the paint not remaining in a workable condition for any length of time. When the use of such paints was first proposed, it was discovered that if a little silicate of soda is added to the vehicle, this converts the oil into a material of the consistency of clotted cream, in which the pigments will remain suspended indefinitely. The early ready-mixed paints were prepared on this basis, regardless of the fact that this setting up of the oil was due to its partial saponification by the soda present in the water glass. The use of such paints, of course, proved disastrous,

and soon brought the name ready-mixed paint into disrepute. Moreover, manufacturers of doubtful reputation were not slow to discover that such prepared paints, in the then state of technical knowledge among painters, provided them with an unequalled opportunity for gross adulteration, with the result that the name ready-mixed paint came to be regarded as synonymous with "worthless rubbish." But it would be unfair to compare such early experiments with the ready-mixed paints of to-day, prepared on scientific lines.

The tendency to separation of the pigment is overcome in different ways in modern paints, the most common being to add water to the extent of 1 to 2 per cent. of the volume of the prepared paint. The proportion used varies with the nature of the pigment employed, some of which show more tendency to separate than others. This water is added to the finished product during the final mixing, whilst the paint is subjected to violent mechanical agitation. In this way an emulsion is formed which stiffens the paint and enables it to hold the pigment in permanent suspension. The presence of this amount of water in the paint does not impair its efficiency as it evaporates entirely as soon as the paint is spread on the surface to be decorated. The emulsification of the vehicle requires in some cases to be assisted by dissolving various metallic salts in the water employed for the purpose. The salts so used include sulphate of zinc, manganese sulphate, borax, etc. Such substances as lead acetate and soda carbonate have been employed by some makers, but these should be avoided, as their presence is deleterious to the paint.

In other cases a minute proportion of organic matter, such as tannic acid, is incorporated with the pig-

ment prior to the first mixing with oil; this has the effect of "deflocculating" it or enabling it to remain in suspension in a liquid by destroying the tendency of the particles to coagulate together to form granules, which is the cause of the separation.

To Test Ready-Mixed Paint.—Open and thoroughly stir the paint, and paint two pieces of glass, say eight inches by six inches, half way over with the paint, giving a full ordinary coat and standing each in a vertical position, one outside and one inside. On observing it against the light I should know whether its covering power was good or bad. On looking at its surface half an hour after painting I should be able to judge of its fineness or freedom from grit. On noticing whether it ran down the glass, showed signs of separation from the oil or shifting its position. I should be able to judge of the quality of the oil used and of its suitability as a paint oil.

I should next look at it with a strong magnifying glass and see whether the magnified paint looked homogeneous or well and intimately mixed. If it did not, I should know that it would not be a stable or lasting paint, as the molecules would undergo change and movement leading to cracking or crinkling.

I should next note the time it took to dry, and the character of the skin formed, noting whether it dried from the bottom or skinned over at the top only, and testing the skin to see how leathery and tough it was.

From these various indications I could assess its general value and suitability for any given purpose, as I should compare its behavior with what I should expect in a well-made sample of white lead paint under similar conditions. There would be no need for a practical painter to put it to any long test of time or to analyze it.

In addition to the foregoing excellent hints we would say that any ready-mixed paint may be quite accurately gauged by its price and maker, as also by its general physical features, such as odor, etc. A first-class article will smell like any good hand-mixed oil or flat paint, and a poor-grade paint will smell of benzine and rosin oil mayhap. A low-price paint will hardly prove to be a good grade paint.

Clear Varnish For Enamel Finish.—Add two quarts of the strongest grain alcohol to four gallons of damar varnish, and shake well. This will give a somewhat darker looking varnish than the original damar, but it will not affect the white finish at all. The alcohol removes the opalescence of the damar varnish, producing a clear, transparent liquid, and making the varnish to dry somewhat harder. Another clear varnish may be made by dissolving one pound of gum sandarach and four ounces of clear Venice turpentine in four ounces of 95 per cent. alcohol in a water bath, with gentle heat. When the gum is dissolved and while still warm, filter through fine muslin.

Baking White Enamel on Galvanized Iron.—White enamel is baked at a heat of not over 180 degrees, F. Use zinc white, not white lead, and bake on several coats, using baking varnish. Bake several hours each coat.

Bath Tub Enamel Paint.—Break up eight pounds best grade zinc white that has been ground in damar or other light varnish, and mix in gradually half pint of turpentine, after which add gradually while stirring two quarts of the best white enamel varnish, not damar. This will make a gallon of the best bath tub enamel paint.

PRACTICAL NOTES FOR THE PAINTER

TIR the paint with a paddle, never with the paint brush.

The keg of white lead in oil should be kept covered with water; zinc white should be covered with oil, as water will harden zinc.

Study the various paint compounds for various purposes, and thus ascertain which is best suited for a particular purpose.

When painting a door, mantel, etc., lay down a sheet of stiff paper or canvas, and so save the floor or its covering from paint spots.

Train your hand so that it will handle a paint brush without spattering paint over things. A new brush will, of course, prove difficult to use without some spattering, but be careful.

Soft or sappy places should be shellaced before priming, or after priming will do, so that the entire surface will be uniform and no paint spots will show. Often spotting is caused by failure to touch up sap or soft parts.

For one thing the durability of any paint will depend upon the number of coats applied, two giving better wear than one, and three being better than two.

Unless used up the left-over paint of the shop will accumulate and be a loss. It is well to add it to the next batch you mix, if within reasonable time, though fatty paint is not fit for ordinary painting.

If left-over paint is placed in a vessel that may be sealed from the air it will keep good for several days, that with turpentine in it remaining good for weeks,

but oil paint with driers in it will go fatty in a few days.

Never leave mixed paint exposed to the air if you can avoid it; if only for a few hours let it be securely covered, to keep it from air and possible dust or dirt.

Too much oil, especially boiled oil, will cause soft paint, but too much driers is the worst offender in the case.

Too much turpentine in a paint will make a hard, inelastic paint, and while such a paint is necessary within doors, too much turpentine should not be added to exterior paint. It hardens paint and makes it brittle, causing cracking and peeling in time.

Dust and flies are the trouble with exterior painting in summer. Watch the signs of the weather, paint a nice front when the winds are still, and when flies and gnats are few. Some advise putting something in the paint to make it obnoxious to flies, but this is hardly worth trying. Select the proper time and weather conditions, and defer painting otherwise if possible.

When mixing paint to get a tint, add the lightest color first, then the darker one, according to depth of color and tinting strength.

When you wish to add a little oil to a japan color first mix the japan color with a little turpentine, then mix in the oil. Then the color will not curdle.

When about to mix colored paint you may save time and labor by breaking up the white lead or zinc separately from the colors, then strain both before mixing together.

The rule with paint makers is one-half pint best turpentine japan drier to eight pints of raw oil, which is calculated to dry the paint in from eighteen to twenty-four hours in fair weather.

Adding a large quantity of oil at the start may cause the lead to break up lumpy.

Where turpentine is used to a large proportion in a paint the quantity of driers used must be reduced or in some cases omitted.

A wall crack filled and coated over with shellac will show a glossy streak after painting, and the best way is to add some lead with the shellac.

White lead is lead carbonate.

Red lead is red oxide of lead.

Litharge is yellow oxide of lead.

Sugar of lead is lead acetate.

Chrome yellow is lead chromate.

There is no remedy for mildewing paint but to wash it off and paint it over again.

Galvanized iron rusts more readily than the bar iron under all bare spots, while steel sheeting rusts sooner than iron sheeting.

The most valuable iron oxides for painting with are the bright reds, the browns, and the yellows.

"I find red lead the best priming paint, as it is hard when dry and resists dampness and heat. The priming paint for outside work should be of a nature to penetrate the wood, dry hard, and hold fast to the fiber of the wood, thus making a sure ground for subsequent coats."

A painter uses this primer for old brick and plaster walls: Add together, dry, 5 pounds yellow ochre, 5 pounds silver white, and 5 pounds white lead, and thin with boiled oil.

Plenty of raw oil with Venetian red that has been ground in oil makes the best foundation for brick wall painting. Apply liberally.

Turpentine should weigh 7 pounds 3 ounces to the standard U. S. gallon.

Benzine when dropped on white paper should evaporate within three minutes; if a greasy mark remains after five minutes it is not good; 63 deg. benzine should weigh 6 pounds 1½ ounces to the gallon, U. S. standard gallon measure of 231 cubic inches.

When painting blinds have a little stick for opening the slats with; leave hand-holds on the sides, to handle the blind with. Keep the paint off the hands as much as possible.

It will require three pounds of 15ct. chrome yellow to do the same amount of tinting that one pound of 25ct. chrome will do. Moreover, you will not get as rich a tint from the 15ct. article, no matter how much more of it you may use.

One-half pound of lampblack in oil, of the best quality, will go farther than two pounds of a low-grade black that will cost only as much as the half pound of black. And you will not get as good results from the inferior black.

Of the two, thin paint is better than thick, but will need more coats. Thick paint will not brush out well, and is apt to crack. Thin paint is more elastic, and wears well, because of the greater amount of oil in it.

Paint should always be stirred every now and again so as to keep the liquids, such as oil, turpentine and japan, thoroughly mixed. If this is not done some parts of the work are liable to dry quicker and others slower, instead of the whole surface drying even and alike.

Comparing the materials which were painted, we find that, generally, poplar retains the paint better than white pine, and would, therefore, be preferred for siding on buildings, etc. Yellow pine seems to be the worst of all for this purpose.

Black iron, as a whole, seems to retain the paint better than either tin or galvanized iron.—*The Railroad Gazette.*

The careful workman will not mix a great deal too much paint for the job in hand; if any is left over, put it in a tin with a cover, and label it, showing what is in the can, with date of mixing.

Paint won't run if it is spread out well. Of course it will run if it is not rubbed out.

Three or four thin coats are far better than two heavy coats on exterior work.

It has been shown by tests that a paint made from 90 parts of good boiled oil and 10 parts of turpentine is less porous when dry than a paint made from either raw or boiled oil alone.

As a rule, gasoline evaporates, in connection with paint, more rapidly than benzine does, by about one-fourth the time.

Too much oil with dry white lead will cause the paint to sag and run.

The Paint Shop Lye Barrel

Many years ago, when a "jour." painter quit work for the day, just a few minutes before his allotted ten hours were up, he would set his pot on the floor and wipe it down, using his brush, and in this way the inside of the pot would be nice and clean. The outside would then be wiped clean with a rag. As a rule, very little paint was permitted to get onto the outside of the pot, but much depended on the character of the work he was on. Nowadays, the boss says it does not pay to let the "jour" take the time necessary for wiping down the pot, and hence it comes into the shop, or remains on the job, very dirty with paint; though

once in a while it will be put into the lye barrel for a cleaning.

The "lye barrel" may be the half of an oil barrel or the whole. Into this put ten pounds of fresh stone lime and pour enough boiling water over it to cover it; and cover up with some bagging, to keep in the heat and steam. Add ten pounds of soda ash or pearlash, or five pounds of caustic soda, or potash, or concentrated lye, adding more hot water to form a thick paste, and stir occasionally. Next morning uncover it and add enough water to leave a strong solution, the more water the weaker the solution; use your judgment. Place the pots in this, and in a short time the paint will become loose, then remove pots and scrape off the paint, then wash off and finish scraping off in running water, or still water if nothing better offers.

As the liquid gradually grows weaker from use it will finally be necessary to remove the liquid from the sediment at the bottom, and then it is well to have the other half-barrel ready, pouring the strained liquid into it and adding more lye to make it strong again. The residue from the first barrel may be treated with clear water, washing out the lye remaining, and finally pouring it out so that it may allow all water to evaporate, after which it may be mixed with some pot scrapings or odds and ends of paints, or with some cheap filling material, and a coarse paint made from it, one useful for various purposes. Or the residue may be mixed at once with old paint and whiting, dry color, etc., and made thus into a rough paint. The little lye present will not seriously affect the paint, and it will enable the oil in the paint, if any be added, to mix well with the watery part of it.

In the paint shop economy there should be no waste, everything should be used and some money made out

of it. Even the paint formed on the board where brushes are wiped out should be collected and boiled up into paint. Foots of varnish and oil, paint-pot scrapings, varnish and paint odds and ends, all should be saved and made into paint. I once made a large washtub full of such paint, in which were old sample cans of wood fillers, varnishes of various sorts, colors and paints, and the usual assortment of the odds and ends of a paint shop. I did not boil it nor add any lye, but thinned down the whole batch with a little benzine and finally with raw oil, after which I strained it carefully and used it as the first coat on my own house, following with a second coat that was made up of the best materials. That job stood well for years before requiring re-painting.

Notes on Zinc White

If the zinc white shows a yellow tint the discoloring is due to traces of cadmium sulphide.

The only action which sulphuretted hydrogen can have on zinc is to form zinc sulphide, which is itself of a white color, and therefore does not injure the appearance of the white coat, and even in tinted coats the action can hardly be noted. It is questionable, however, if the sulphide of zinc is formed at all.

Zinc oxide is prepared from (1) metallic zinc and (2) from zinc ore. The latter is known as the "indirect" process, and is mostly used in the United States.

Pure zinc has an extraordinary capacity for spreading (much more so than white lead) which must not be confounded with covering as understood by painters. A very much larger area can be covered with pure zinc than with white lead, but it would not be solid.

Zinc white should always be kept in zinc tins or in tinned iron vessels. If put in wooden casks the latter absorbs the oil from the paste, which deteriorates it. It should never be covered with water, which disintegrates it. Oil should always be used for covering the zinc when the keg is once opened.

To test the purity of zinc white in its dry state, it may be heated and then allowed to cool, when it must return to its original whiteness. Boiled in dilute nitric or muriatic acid, it should dissolve completely without effervescence. If it effervesces during solution, there is some carbonic gas present, due to white lead, whiting, or carbonate of zinc. If any insoluble matter be present, it is most likely barytes. To test zinc in oil, wash out the oil with gasoline or ether, and after drying the pigment, test as above.

The very best zinc oxide has an apparently poorer covering quality than white lead, but we are informed by those interested in the matter that if we take zinc and lead pound for pound, and not by mere bulk—zinc being bulkier than lead—we shall find that it covers quite as well as lead. It is said that the lower grades of zinc oxide, or what passes for such, have very much less covering power than the best grade. White lead cannot easily be adulterated to any extent without detection by any user; but it is said to be different with zinc, which may easily be adulterated and then its short-comings are blamed upon the zinc itself.

Leaded zinc is now adopted to indicate an oxide of zinc which contains a proportion of basic sulphate of lead. The presence of lead is due to the mode of production of the pigment, and the nature of the ore from which it is obtained. A well-known authority has brought out clearly that provided the proportion of

lead did not exceed a reasonable limit the pigment did not suffer, but on the contrary became a better protective medium.

Perfect Color Combinations

The following table of color combinations was compiled by an expert artist:

Black and white.
Blue and gold.
Blue and orange.
Blue and salmon.
Blue and maize.
Blue and brown.
Blue and black.
Blue, scarlet and lilac.
Blue, orange and black.
Blue, brown, crimson and gold.
Blue, orange, black and white.
Red and gold.
Red, gold and black.
Scarlet and purple.
Scarlet, black and white.
Crimson and orange.
Yellow and purple.
Green and gold.
Green, crimson, turquoise and gold.
Green, orange and red.
Purple and red.
Purple, scarlet and gold.
Lilac and gold.
Lilac, scarlet, and white or black.
Lilac, gold, scarlet and white.
Lilac and black.
Pink and black.
Black, with white or yellow and crimson.

PIGMENTS NOT AFFECTED BY SULPHUR GAS.—Zinc white, barytes, silica, China clay, lithopone, terra alba, whiting. Zinc lead and sublimed lead are nearly proof against gas. Yellow ochre, Venetian red, Indian red, Tuscan red, ultramarine green, all the brown earth pigments, such as umber, Vandyke brown, iron oxides, etc., lampblack, drop black, ultramarine blue, Prussian blue.

PIGMENTS NOT AFFECTED BY ALKALI.—Barytes and whiting, yellow ochre, Venetian and Indian reds, cobalt, ultramarine green, siennas, Vandyke brown, iron oxides, lamp and drop blacks, ultramarine blue.

PIGMENTS PROOF AGAINST LIME.—Barytes, lithopone, zinc white, whiting, China clay, yellow ochre, Indian yellow, iron oxide reds, madder reds, and in less degree, red lead and English vermilion, cobalt green and terra verte, umbers and Vandyke brown, lampblack and drop black, cobalt and ultramarine blue.

PERMANENT PIGMENTS.—There are, to speak accurately, no absolutely permanent pigments, although the natural pigments come nearest to being permanent of any used in the painting business.

Generally speaking, dark colors are more permanent and endowed with a larger capacity for service, than the lighter ones, which in large part are made artificially or with a dye base. This does not imply, however, that all chemically produced colors worked out upon a dye base, or otherwise, are fugitive mediums, because, as is well known, not a few of the most durable and finest pigments belong to the artificial class.

Nevertheless, a majority of the chemically prepared colors possess a fleeting quality, although such colors

are very brilliant in tone and beautiful in their surface effects.

The rich and quiet effects produced from the use of the dark, subdued colors, have a tenacity of lustre, and a permanence of surface film which makes them very desirable from about every available point of view. Moreover, such colors are less affected by the varnish coats.

THE WHITES WITH VARIOUS NAMES.—Frequently when reading about paint or colors we come across unfamiliar names of familiar substances, and the following little list will tell of the different names certain white pigments are known by:

Whiting.—Bolted gilder's whiting, Spanish white, Paris white, English cliffstone, chalk, commercial whiting. Its name in chemistry is calcium carbonate, or carbonate of lime.

Gypsum.—Terra alba (meaning white earth), alabaster, alabastine, plaster of Paris. It is a natural sulphate of lime. Hydrated calcium sulphate.

Soapstone.—Steatite, talc, French chalk, hydrated magnesium silicate.

Silica.—Silex, quartz, silicon dioxide.

China Clay.—Kaolin, white bole, hydrated aluminum, silicate.

Blanc Fixe.—Permanent white, precipitated barium.

Barytes.—Heavy spar, barium sulphate.

Zinc Oxide.—Zinc white, oxide of zinc.

The pigments that contain sulphur are vermilion (sulphide of mercury); cadium yellow (sulphide of cadium); ultramarine blue and sulphide zinc white.

IMITATION ARTIST COLORS.—Where the work demands artist colors, and the price will not admit of

the more expensive pigments, they may be imitated very nicely as follows:

Madder Brown.—Indian red and a little brown added to any cheap crimson.

Purple Lake.—Vermilion and a little ultramarine blue.

Brown Pink.—Raw sienna and a little Vandyke brown, with a touch of Prussian blue.

Auroelin.—Medium chrome yellow and lemon chrome yellow with a touch of white.

Cobalt Green.—White lead, Prussian blue, and a little Brunswick green; or white lead, ultramarine blue and emerald green.

Sepia.—Burnt sienna and lampblack with a touch of Indian red; or, black, Venetian red and burnt umber.

To Darken Colors.—To darken greens add black or blue. To lighten add yellow or white.

To darken blues add Prussian blue or black; to lighten add white.

To darken vermilion add Indian red, or Venetian red, umber or Vandyke brown, according to the shade desired.

To darken Indian red or Venetian red add umber or Vandyke brown; to lighten add vermilion.

To darken umber or Vandyke brown add black; to lighten add Indian red or Venetian red.

Absorption of Oil.—A color maker reports the results of experiments in the absorption of linseed oil by pigments in the process of grinding to paste form as follows, in 100-lb. lots:

Burnt umber took 93 lbs. oil, or 83 per cent.

Raw umber took 74½ lbs. oil, or 64.4 per cent.

Burnt sienna took 104 lbs. oil, or 93 per cent.

Raw sienna took 128½ lbs. oil, or 128½ per cent.

Colors, Permanent and Fugitive.—Chrome yellow is fugitive, and becomes dark in air containing sulphur.

The umbers and siennas, burnt and raw, burnt ochre and Vandyke brown, all are stable colors.

Ultramarine blue is the only blue that will stand, while Prussian blue, cobalt blue, Antwerp blue and indigo blue will fade, singly or in combination.

Of the reds, those to be depended upon are Venetian red, Indian red, light red and madder lake. For exterior use it is better to avoid chrome red, carmine lake and vermilion.

Green made from Prussian blue and chrome yellow will fade on exterior work, the Prussian blue fading out. Better make outside green with ochre and black, though there are some chemical greens made that stand very well outside.

Pigments produced by heat will change under the influence of heat of a different character or temperature; they all generally deepen.

A Useful Mixing Rule.—*For each gallon of oil used take as much pigment as four times the specific gravity of the pigment.*

We give below a few samples of paint mixed in accordance with this rule:

One gallon of oil requires 26.40 lbs. of dry white lead.

One gallon of oil requires 21.20 lbs. of dry white zinc.

One gallon of oil requires 20 lbs. of Indian red.

One gallon of oil requires 12 lbs. of yellow ochre.

One gallon of oil requires 11.84 lbs. of umber.

One gallon of oil requires 10.40 lbs. of bone black.

To Hasten Drying of Certain Pigments.—White lead helps the drying of any pigment it may be added to, and a little burnt umber will assist Vandyke brown in drying, the latter being a very poor drier. A minute portion of red lead will help the drying of lakes without materially injuring their beautiful hue. Raw sienna is a poor drier, and a little raw umber will help it dry and not alter its tone. A mixture of a little Prussian blue and red lead mixed as a dark grey, will always secure the drying of black without interfering with its intensity. Indeed, a very good black, such as artists use, may be made with Prussian blue and red.

Test for Turpentine.—The mineral oils, benzine, gasoline, naphtha, etc., are soluble in turpentine; aniline oil also is soluble in turpentine. But the mineral oils are not soluble in aniline oil. Mix 80 parts turpentine with 20 parts benzine and you get a clear, clean, uniform solution; having placed this solution in a small vial, add 100 parts of aniline oil and shake for half a minute or so. Allowing it to rest a minute, we shall find two distinct and separate layers in the vial. The explanation is this: the aniline oil can and does mix with the turpentine; it cannot, however, mix with the benzine. The result is that the benzine is forced out of the turpentine mixture by the aniline oil and must float by itself on top of the new mixture of aniline oil and turpentine. This experiment may be made with a little vial, say three inches high and one-half inch in diameter. Into it pour about one inch of the aniline oil, on top of this pour an equal volume of the turpentine to be tested. Close the vial with your thumb, shake, then set aside a few moments. If after say five minutes the mix-

ture remains uniform then it contains no added mineral oils. After standing a day or two a separation will sometimes take place, but this is due to a change in the aniline oil.

Condit mentions an instance of pump rods being coated with red lead and immersed for forty-five years in a well 200 feet deep, and at the end of that time their weight was found to be precisely the same as when new, there having ensued no loss from rust.

G. Bouscaren, C. E., states with regard to the painting of bridges, that having used both varieties of paint, he gives preference to the red lead. The red-lead paint adheres better to the iron and fails principally by wear and a gradual transformation of the red lead into carbonate, whilst the iron paint fails by scaling.

COMPOSITION OF PAINTS AND THEIR COST

THE following is taken from a bulletin issued in the autumn of 1912 by the United States Department of Agriculture, the title of the bulletin being, "The Use of Paint on the Farm." It is very interesting and instructive reading for the painter, and is a part only of the bulletin, the rest of it not particularly interesting the painter:

It probably would not be denied by any one that a better paint can be made in a well-equipped factory than by an individual at home or in a small shop. Many ready-mixed paints are of the very best quality, but many are of poor quality, made of cheap materials, and at the same time are sold with extravagant claims, and for high prices. The number of different formulas found on the market is enormous, and no attempt will be made to give a complete, or even a representative list of them. An effort will be made, however, to give a few typical formulas of paints and the methods of calculating the cost of making paints whose composition is known. A very good rule to follow in purchasing mixed paints is to buy nothing which does not bear the name of the manufacturer. If the manufacturer's name does not appear on the label, this is very good presumptive evidence that he is not particularly proud of his product. Many States require that the composition of paint should be stated on the label, and a large number of the best manufacturers do this, whether their products are sold in a State requiring such labeling or not.

The most expensive paints are generally white paints or very light tints. The reason for this is that

there are comparatively few white pigments which have covering power, *i.e.*, the property of hiding the surface of the material painted. Samples of dry white lead and of dry whiting look much alike. Both are white powders, and a thin layer of each appears to be practically opaque. If, however, the two pigments are mixed in oil the whiting is transparent, while the white lead is opaque. All of the cheaper white pigments are more or less transparent in oil and are, therefore, deficient in covering power. White lead, zinc white, sublimed lead, zinc lead, and lithopone are practically the only white pigments which have good covering power in oil. These pigments are all rather expensive, and as they are heavy, it takes a large amount to make a paint.

Of the dark shades there are a number of cheaper pigments which have very good covering power. It will be quite safely stated that for a white paint that really covers, some one or more of the white pigments just enumerated must be used. For a dark brown, however, a good covering can be obtained with an iron oxide pigment, which is very much cheaper. Therefore, for such paints, there is no reason for using an expensive lead or zinc pigment.

Estimated Cost of White Paints

A vehicle for outside paint of the best quality will generally consist of from 90 to 95 per cent. of linseed oil, and from 10 to 5 per cent. of japan drier. A good japan drier has about the same specific gravity as linseed oil, and each may be considered to weigh about $7\frac{3}{4}$ pounds to the gallon. Of course, the price of all paint materials vary, but at the present time, linseed oil sells for approximately 90 cents per gallon,

and a good grade of japan can be bought for $1.60. In making up paints the drier should be mixed with the larger portion of the oil before adding the pigment. Using the prices and weights just given for linseed oil and japan drier, the liquid portion of a paint will cost about 95 cents a gallon, or 12¼ cents a pound. White lead, both dry and in the form of paste, costs approximately 7 cents a pound, zinc white approximately 8 cents a pound, and the other white pigments which cover well will not differ much from these two in price. A gallon of white lead paint will weigh from 21 to 22 pounds. Fourteen pounds of dry white lead and 7¼ pounds of vehicle will make a gallon of paint, and at the prices quoted the cost would be about $1.87; 15 pounds of paste lead and 6¼ pounds of vehicle will make a gallon of paint, costing $1.82; 9½ pounds of white zinc and 5¾ pounds of paint vehicle will make a gallon of zinc white paint, costing about $1.46.

Of course, these prices are based on an assumed cost for the ingredients, and to make an exact estimate it would be necessary to know the exact prices of the different materials entering into the paint. Many painters insist that a paint composed entirely of white lead, linseed oil, and drier is the best. Others contend that a mixture of white lead and zinc white is best, and still others say that a mixture of these pigments with the cheaper white pigments which have slight covering power, makes a better paint than the expensive pigments alone. It is probably true that a mixtue of lead and zinc is supeior to either pigment by itself, and also that the addition of a small amount of so-called inert pigments (silica, whiting, barytes, china-clay, etc.) has no injurious effect on the paint, and may even be beneficial. The addition of

a large amount, however, of such pigments, will give a paint deficiency in covering power, and the addition should have the effect of cheapening the product. There is no reason why any mixed paint should cost per gallon more than a paint made entirely of white lead and the necessary drier. By ascertaining the market price of white lead and linseed oil, the buyer should be able to calculate the maximum price for a mixed paint.

Two samples of ready-mixed white paints which were bought at the same time, at practically the same price, will give an illustration of the difference in price of such materials. No. 3361, a white paint, weighed 12.4 pounds to the gallon. The total paint consisted of 63 per cent. pigment and 37 per cent. vehicle. The pigment contained 30 per cent. zinc lead, 13 per cent. white lead, 7 per cent. whiting, and 50 per cent. barium sulphate. Assuming the value of the zinc lead to be the same as that of the white lead, 43 per cent. of the pigment was worth 7 cents a pound, and assuming the value of the whiting and barium sulphate to be 1 cent a pound, 57 per cent. of the pigment was worth 1 cent a pound. The average price per pound of the pigment would, therefore, be 3.58 cents. A gallon of the paint weighs 12.4 pounds, of which 63 per cent., or 7.812 pounds, is pigment; this, at 3.58 cents a pound, would cost 28 cents. Thirty-seven per cent. of vehicle in the gallon of paint will weigh 4.588 pounds. In this paint it consists of linseed oil and a cheap benzine drier, costing about 11 cents a pound, or 50 cents for the vehicle. The total cost of the materials in the paint, then, would be 78 cents per gallon.

Another paint, No. 3864, weighed 14.8 pounds per gallon and consisted of 58 per cent. pigment and 42

per cent. of vehicle. The pigment was 55 per cent. white lead and 45 per cent. zinc white. If the price of these two pigments was 8 and 7 cents respectively, the average price of the pigment in this paint would be 7.55 cents per pound. Since the gallon of paint weighed 14.8 pounds and contained 58 per cent. of pigment, a gallon contained 8.584 pounds of pigment and 6.216 pounds of vehicle. The vehicle in this case was linseed oil and a good grade of turpentine drier. The pigment in this gallon of paint would be worth 65 cents (8.584×7.55) and the vehicle 76 cents 6.216×12.25). The total cost of the materials in this paint, therefore, would be $1.41.

These two paints, as before stated, were bought at the same time and at practically the same price. The prices paid would not be indicative of their value at the present day, since they were bought several years ago, when paint materials were considerably cheaper than they are now; but it is obvious that the margin of profit was very much greater on paint No. 3861 than on No. 3864.

Tinted paints, at least those of light tint, consist practically of white paint with the addition of a small amount of coloring matter. The coloring materials used in tinting are not uniform, and it is not possible, therefore, to give exact directions for producing a particular shade, since the amount of color used will depend upon the individual characteristics of the particular lot on hand. In general gray tints are made from white paints by the addition of a black pigment such as lampblack or bone black, and sometimes a small amount of red and blue is used also. The total amount of coloring matter employed varies, but rarely amounts to as much as 5 per cent. Buff may be made by the addition of black, red, and some-

times yellow. Yellow and cream may be made by the addition of ochre or chrome yellow; frequently for this purpose golden ochre is used, which is ordinary ochre brightened by the addition of small amounts of chrome yellow. Blue tints may be made by the addition of small amounts of Prussion blue. This is a powerful tinting pigment, and it is seldom that more than 1 per cent. is required. With the white paints which contain no lead, ultramarine blue may be used instead of Prussian blue; but ultramarine blue should not be used with lead paints.

Besides the tinted white paints, bright colors are sometimes desired, especially green, for blinds, and reds for trimmings of houses or for machinery. These paints seldom contain any large amount of the expensive lead and zinc white pigments, but consist of comparatively small quantities of coloring matter and large amounts of the cheap white pigments. For black paints there is practically only one coloring substance, namely, carbon, which, however, occurs commercially in a number of forms. The color of so-called drop or ivory black is carbon, obtained from charred bone; lampblack is carbon in the form of soot. The latter, although very pure, does not make a satisfactory black alone, the heavier forms of carbon, such as bone black or even ground charcoal, producing a better black.

In the following table is given the composition of several tinted paints, and also of bright red, bright green, and black. The composition of individual lots of paint of any of these tints or colors might vary considerably from that given, and the table is only illustrative of the materials from which these different kinds of paint may be made. An estimate of the cost of the raw materials entering into the different for-

COMPOSITION AND COST OF TINTED AND COLORED PAINTS

DATA	TINTS						COLORED PAINTS		
	Gray	Buff	Yellow	Dra	Blue	Brown	Red	Green	Black
Percentage composition:—									
Vehicle	43.4	43.0	45.0	41.0	43.0	49.0	57.0	34.0	65.0
White lead		0.21				12.0			
Zinc White	21.0	21.0	25.0	21.0	22.0	24.0	2.0		
Sublimed white lead	27.0	29.0		26.0	27.0				
Barium sulphate	2.0		5.0	2.0	2.0	5.0	25.0	49.0	
China clay	5.0			4.0	4.0				
Whiting							11.0		
Ground slate									26.0
Asbestine	1.0	1.0	1.0	1.0	1.0	1.0			
Color	.6	6.0	11.0	5.0	1.0	9.0	5.0	17.0	9.0
Total pigment	56.6	57.0	55.0	59.0	57.0	51.0	43.0	66.0	35.0
Nature of color	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weight in pounds per gallon:—									
Total	14.7	14.8	14.1	15.2	14.8	13.4	11.6	16.4	10.0
Pigment	8.32	8.44	7.76	8.97	8.44	6.83	4.99	10.82	3.50
Vehicle	6.38	6.36	6.34	6.23	6.36	6.57	6.61	5.58	6.50
Cost per pound, dollars:—									
Color	0.05	0.04	0.05	0.05	0.30	0.05	0.78	0.19	0.10
Total pigment	.065	.069	.066	.065	.070	.066	.103	.056	.033
Cost per gallon, dollars:—									
Pigment	.541	.582	.512	.583	.591	.451	.514	.606	.116
Vehicle	.782	.779	.777	.763	.779	.805	.810	.684	.796
Total	1.32	1.36	1.29	1.3	1.37	1.26	1.32	1.29	.91

(1) Bone black; tuscan red; ultramarine blue.
(2) Umber and ochre.
(3) Golden ochre.
(4) Ochre and bone black. (5) Prussian blue.
(6) Bone black; venetian red; chrome yellow.
(7) Para-red.
(8) Five-sixths chrome yellow, one-sixth Prussian blue.
(9) Carbon.

mulas is also included. The cost per gallon does not make any allowance for labor or for containers, but is based solely upon the cost of the raw materials, assuming that white lead and sublimed white lead cost 7 cents a pound, white zinc 8 cents, and the other white pigments, barium salts, china clay, whiting, and asbestine, 1 cent a pound. The price of the coloring material is given separately for each paint. These prices for the raw materials are a fair approximation of the retail price at the present time. In calculating the cost of the paints per gallon it is assumed that the vehicle in all cases is the same as that described under "Estimated Cost of White Paint," and it is valued at 12¼ cents a pound. An inspection of the table shows that there is comparatively little difference in the cost of the materials entering into these paints, with the exception of black paint, which is considerably cheaper than any of the others. The red paint is colored by an expensive color, para-red, costing 78 cents a pound; the rest of the pigment, however, is cheap, and it will be noticed that the paint weighs only 11.6 per gallon, whereas some of the others weigh much more.

For dark shades of red or brown there is probably nothing which is as cheap as the oxide of iron pigments. These vary very much in shade, giving both browns and dull red. A pigment that gives a very satisfactory reddish brown and contains about 40 per cent. of iron oxide, makes a very satisfactory paint containing approximately 56 per cent. pigment and 44 per cent. vehicle, the vehicle being very much the same as that used in a first-class white paint. Such a paint will weigh about 13.5 pounds to the gallon, which, therefore, will contain 7.56 pounds of pigment and 5.94 pounds of vehicle. This pigment

is cheap, generally costing not more than 1 or 1½ cents per pound. The pigment in a gallon of this paint, therefore, would cost approximately 10 cents, and the 5.94 pounds of vehicle about 73 cents, giving a cost of 83 cents for the gallon of paint.

An inspection of these figures shows that the expensive part of this paint is the vehicle and not the pigment. A paint of this character is a very good material to apply to either wood or iron. There are more expensive paints, however, frequently used on iron to protect it from rusting, the most popular being red lead and linseed oil. This material undoubtedly affords very good protection, but it is also expensive. A red-lead paint cannot be made and kept as other paints can. The red lead itself causes the oil to dry, and no additional drier is necessary. In fact, red lead should not be mixed until just before it is used. A paint made of 70 per cent. of red lead and 30 per cent. of linseed oil, will weigh about 19.8 pounds to the gallon. A gallon of paint, therefore, will contain 13.86 pounds of red lead, which costs about 8 cents a pound, making the cost of the pigment in a gallon of this paint approximately $1.11. The 30 per cent. of linseed oil will weigh 5.94 pounds, and a gallon of linseed oil 7.75 pounds, costing about 90 cents at the present time, or 11.5 cents a pound. The oil in the paint will cost, then, about 68 cents, and a gallon of red lead paint would cost $1.79, as compared with 83 cents for a gallon of oxide of iron paint. These two paints will cover about the same area of clean iron, and while somewhat better service might be expected from the red lead paint, it is more than twice as expensive as the iron oxide products.

The Use of Rubber Paint

So-called rubber paint has been in use for many years, but in some instances at least, the rubber existed only in the name, none being in the paint. But raw rubber is used in the making of damp-resisting paint for certain purposes. The value of such a paint, however, depends upon the retention by the rubber, after solution, of the unique properties for which it is used, and experience has shown that the quality of the rubber exerts no inconsiderable influence on the elasticity and durability of the paint. But much depends upon the proper solution of the rubber, for if this is not accomplished right the rubber will not mix perfectly with the paint, but remain in particles without becoming an actual part of the paint in the sense in which it should. The solution of the rubber in solvents is a discussed question with those who have studied the subject, and the weight of evidence seems to support the view that the rubber does not "dissolve" in the common sense of that term, but that the particles simply become jellified, and, in that state, are distributed throughout the paint, inducing in the mass a sort of colloidal condition. Be this as it may, it is certain that different samples of nominally pure rubber yield entirely different results after treatment with solvents, and recent investigation has suggested a probable reason for this. It has been found that a rubber is now obtained from a tree entirely different from the Heveas or true rubber tree, and true rubber is adulterated with this, or is used as a substitute for the true rubber. This new rubber is less elastic than the true, and differs in other respects.

The Para or true rubber may be dissolved in disulphide of carbon, with coal tar benzol, or with tur-

pentine spirits, and in this condition may be mixed with linseed oil. The rubber is first cut into strips and placed in a vessel that can be perfectly stoppered, then the solvent is poured over the rubber to cover the strips; allow the vessel to be in a warm place and shake it now and then. If the mass becomes very thick, add more solvent, to make it more fluid. Then it may be mixed with boiled oil, first straining it to remove sediment; then the mixture may be heated on a sand bath, to effect perfect amalgamation. Solutions with coal tar benzol are preferable to those made with disulphide of carbon, the latter being very volatile, and when it does leave the mixture the latter will be found full of rubber-like particles.

Rosin Oil Paint

In place of linseed oil, solutions of rosin in turpentine, benzine, benzol, or other hydrocarbons with or without admixtures of drying oil, rosin oil or mineral oils, are used in the preparation of paints intended for purposes of minor importance. Such paints are suitable for cases where no particular importance is attached to durability, for painting unplaned wood, etc.

It is, of course, the binding agent, *i.e.,* the liquid mixed with the body colors, which principally determines the drying, the brilliancy and the durability of the paints. Simple solutions of rosin in turpentine oil and similar volatile liquids, dry most rapidly, but they have little durability; they rapidly deteriorate when exposed to the air or to the action of moisture, and can be rubbed away in the form of powder as

soon as they are dry. A certain quantity of drying oil is added to the solutions to increase their durability; this, however, again delays the hardening and consequently, the work. Besides drying oil, rosin and mineral oils are employed for such paints, and in this way an appreciably cheaper product is obtained than when drying oils are used. On the whole, the preparation of these cheap paints is a fairly easy matter. The rosin is either ground or dissolved in the solvent by means of stirring, shaking and moderate heating, and the liquid thus obtained clarified by storing for a short time, or the rosin is melted, the drying oil, rosin oil or mineral oil added, the whole placed over the fire for a time, and finally mixed with the diluent. Then the product is stored to clarify and at last ground with the body colors in a fine powder in a paint grinding machine. All body colors, with the exception of white lead, zinc white and red lead, can be used for these paints, and every shade of color can be produced, but in most cases the selection is restricted to the mineral colors (yellow, red, brown and black and chrome green), while bright tints are prepared by means of lithopone (opaque white). Lead and zinc colors are only used when a resinous compound (resinate) takes the place of rosin. As in the case of all ready colors intended for paints, it is very important that the body colors should be powdered very fine, and that they should be thoroughly ground with the binding agent in order to obtain a uniform unguent-like product which can be spread evenly and in a thin layer.

With all compounds containing benzol, solvent naphtha or benzine as diluents, great care is necessary on account of their excessive inflammability; no fire or light should be allowed in the workshop.

How Much Surface to a Gallon of Paint?

This question is asked so often, and can be answered in a general way as follows: Under the average conditions a gallon of paint will cover 300 square feet, two coats. To be more particularly answered we will have first to say, it depends upon the surface, whether it is new lumber or one that has been previously painted; or if it be metal, whether smooth sheet iron or tin or rough structural steel, such as bridge work, etc.

To the unthinking, a paint is valued at its cost per gallon. To those who can see a little further, a paint is valued not per gallon, but by cost per square yard or the finished job. Those who inquire still further, look into the durability of the paint and realize that the paint that puts off for the longest time the necessity for repainting is the best and cheapest.

The wearing power, or durability of paint depends not only upon its own qualities, but the surface, the weather conditions while being applied, the manner in which it is applied, and several other points.

The object of this article is to discuss the manner of application, or what effect the thickness of the coat or film has upon durability.

Manufacturers are often led into making extravagant claims for the covering power of their paint, some saying 1000 square feet to the gallon on metal. It is evident to all that the greater the surface covered per gallon of paint, the less the cost for material per square yard, or per job. This point of first cost is made so prominent that the effect of spreading or extending the paint over an area in excess of its ability to properly protect it, is overlooked. We wish to emphasize this point. A paint film can easily be too thin to afford maximum protection.

The usual limitation placed upon the paint is that so long as it hides the surface satisfactorily it can be spread as far as it can be brushed out. We think this is a great mistake, for there are two classes of paints that cannot be so treated with best results from the standpoint of durability. First, there are those dark paints which possess such splendid hiding power that they can be brushed to the furthest limit. We will consider the second class a little later.

Let us take, for example, one of the red oxide or graphite paints, which come in the first class. It is possible to spread them out so thin that the coat will be less in thickness than tissue paper, and it is unreasonable to expect a paint film as thin as this to afford the maximum protection. If three or four coats are applied of this thickness, the results would be very satisfactory, but the labor cost, as well as the material consumed, would be too great to make this proposition one to be considered.

We are then brought back to the question, "How much surface to the gallon of paint?" and qualify it by adding, "and obtain greatest durability?" In our opinion for one-coat work on metal or wood a gallon of paint should not be spread over 450 square feet for maximum protection, no matter what its color or body. Two-coat work, not over 600 square feet per coat, or 300 square feet per gallon, two coats.

The second class referred to above, are those light-colored paints that will not cover or hide the surface satisfactorily if spread as thin as the dark paints. The tendency is to apply these paints as heavily as possible, in order to hide the surface; this result is being impaled on the other horn of the dilemma, and we have a paint film too thick to dry satisfactorily, and one that is sure to give trouble sooner or later

in peeling, cracking, or scaling. It makes an unsafe foundation for subsequent coats of paint and is altogether unsatisfactory.

No one should yield to the tempation of attaining covering at the expense of durability, by applying paints relatively poor in covering qualities in heavy coats, nor, on the other hand, should they apply paints relatively strong in covering power in coats too thin for durability.

There are limits then, on either hand, beyond which it is not safe to go, and care and judgment must be exercised by the painter to keep within bounds.

To find the number of gallons of paint that can be made from a mix of 100 lbs. of white lead, you may consider that the lead alone is equal to $2\frac{3}{4}$ gallons. Add to this $2\frac{3}{4}$ gallons the number of gallons of oil, turpentine, dryer, etc., and you will have the number of gallons of paint produced.

It is often convenient and effective when soliciting business to be able to say what pure lead paint will cost per gallon as against anything else the property owner would think of using. For this reason it is well for each painter to make a memorandum to keep handy showing the cost of all materials used to mix up 100 lbs. of white lead—cost of oil, turps, dryer and colors. By dividing the total cost of lead, oil, colors, turps and dryer by the number of gallons of paint thus produced, you will get the cost per gallon.

How Much Oil to 100 Pounds of Lead?—When estimating on the job you may allow five gallons to the hundred pounds of lead, and this will see you through all right. A pint of good liquid drier will be enough for this quantity of paint. Many use twice or three times as much, but we could do it with

even less than a pint, and this on outside work. Zinc white takes about half as much more oil than lead does, and twice as much driers, being a poor self-drier, while lead is a good drier. Raw linseed oil is also a good self-drier.

How Much Paint Will 100 Pounds of Lead Make,—In general, white lead, as found in the keg, runs from 600 to 700 cubic inches per 100 lbs., averaging about 650 cubic inches, which corresponds to 2.8 gallons per 100 pounds. Add oil to this and you get mixed paint according to the amount of oil added, or turpentine, also the driers, must be counted.

The covering or spreading capacity of any liquid must depend on the thinness of the fluid. A bronze paint thinned with turpentine or benzine, with a little varnish to bind it, will cover more surface than one mixed with banana liquid. Say the former paint will cover about 800 square feet of surface, then the latter will cover only 700 square feet. An ounce of bronze powder will cover about 25 square feet of average surface, one that is not absorptive. To ascertain the number of pounds of white lead paint that will be required to cover a given surface, of wood, divide the number of square feet by 200, which will give the number of gallons required for two-coat work. The usual estimate for ready-mixed paint is that it will cover about 500 square feet of average surface, one coat. Remember, however, that all such estimates are merely approximate, many factors entering into the problem to affect the result.

There is no standard for the spreading rate of oil paint in practice, but a paint that is in a condition for ordinary painting can be brushed out to cover 1200 square feet of a fairly smooth surface to the gallon

of paint. Indeed, in most cases, if not spread out at this rate, the paint will run.

The Man Who Wants to Economize

Every once in a while you meet a man who has an idea that white lead paint is expensive, and while it may be the best paint, he cannot afford to use it on his house. Or, he may have only a certain amount he can spend for painting, and thinks the only way to make it do it to buy some cheap paint and get a man who once whitewashed a hen house for him, to spread it.

The man who really wants to economize on his painting cannot afford to use anything but white lead and linseed oil paint, but he has to be shown, and it is usually necessary to start right in at the beginning and go through the whole proposition with him, and as he probably measures the cost of paint by the cost per gallon, that is the place to open up with some figures.

If he is going to paint white, figure out the cost of the following mix, which would be an average for old work in fair condition:

100 lbs. pure white lead.
4½ gallons linseed oil.
1 gallon turpentine.
1 pint japan drier.

One hundred pounds white lead bulks 2¾ gallons, so this will mix 8¼ gallons of paint ready to spread. At retail prices prevailing in larger cities of the East and Middle West, this will figure out from $1.50 to $1.60 per gallon. Freights will increase this cost, depending on the distance from paint manufacturing centers, but all paints and paint materials increase in proportion, so the comparison remains the same.

Now what can he get for that price per gallon except mail order paint at $1.11 per gallon, freight *not* prepaid? And if you are posted on the paint that comes into your neighborhood, you can refer him to a job done with mail-order paint, which will settle the question then and there.

If he wants some dark paint—chocolate brown, for example, figure out this mix at your local retail prices:

100 lbs. white lead.
25 lbs. burnt umber.
10 lbs. burnt sienna.
Little medium chrome yellow.
5½ gallons linseed oil.
½ gallon turpentine.
½ pint japan drier.

This mix will make 11 gallons of paint, and while it will figure out 15 cents to 25 cents per gallon higher than white or light tinted paints, it can be brushed out thinner and will cover enough more to offset the higher cost.

When it comes to covering power, there is no paint that can be brushed out like white lead paint, and a gallon will cover a fourth to a half more surface than a mixture that must be flowed on thick in order to hide the surface beneath.

Now, having him beaten at cost per gallon and cost per square yard, go at him on durability with some examples of your own work that are still in good condition after years of service. And don't fail to point out at the same time the trouble some one has had with cracked and scaling paint that had to be burned off before paint could be made to stick, and how this never occurs with pure white lead paint.

The man who wants to economize surely cannot afford to use anything but pure white lead.

Definitions of Color Terms

Color is any of the primary, secondary or tertiary colors.

Hue relates to a particular tone of color; thus, there are purple-blue, orange-yellow, etc.

Tint is produced by adding a little color to white.

Shade is obtained by adding black to a color.

Grey is produced by adding a little black to white.

Gray is produced by tinting white with blue, black, and a little red; on some grays a little yellow is also added, making a warm gray.

Hot, as applied to color, means red; it is the hue of fire. Some think it actually influences the temperature in a room that has it in quantity.

Warm, as applied to color, means yellow, and its modifications. It is advised for north rooms.

Cold, as applied to color, means blue, which is the color of ice, and suggests coldness. Blue and its modifications are suggested for sunny rooms, when it is desired to make them appear less warm. Green is considered a cool color.

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